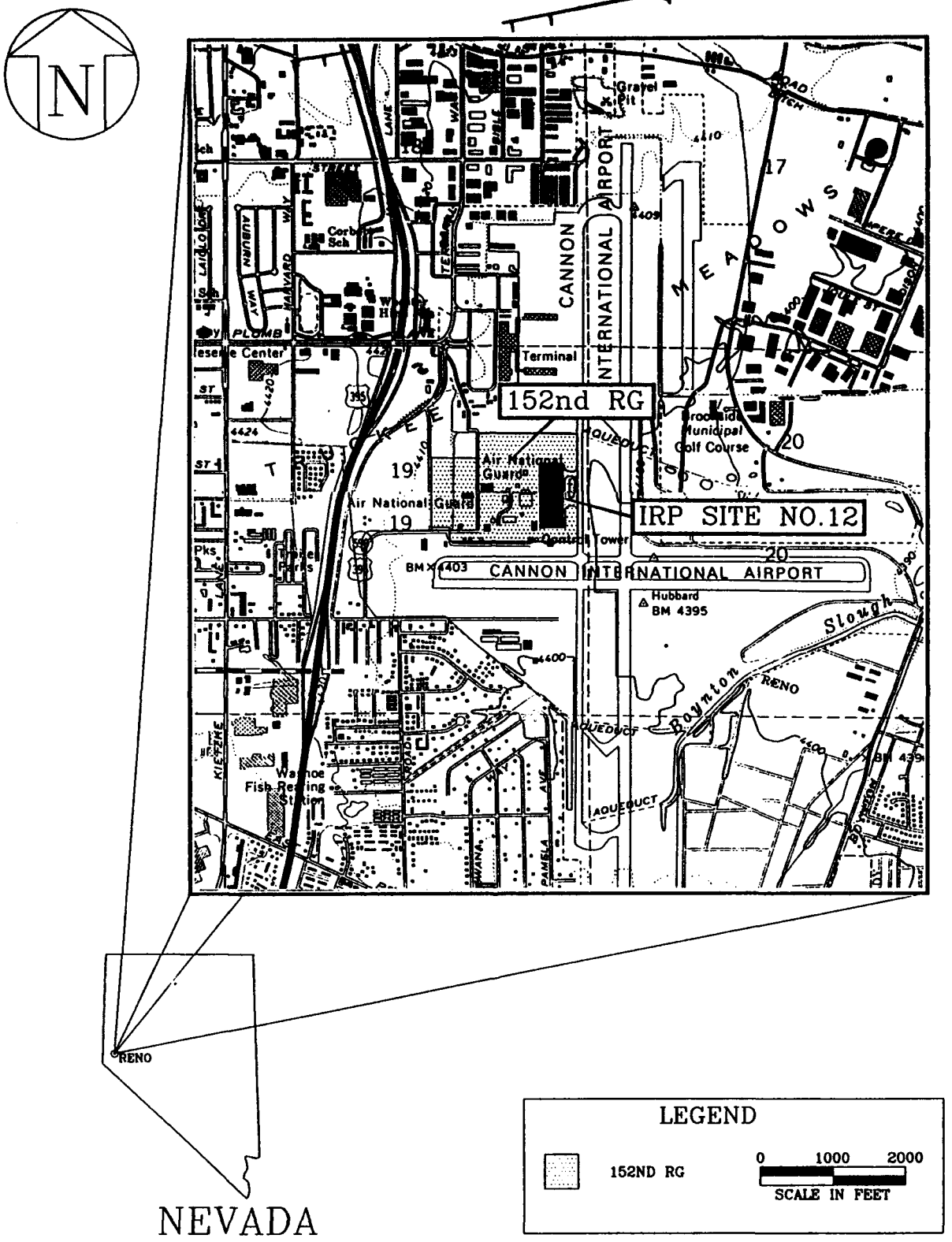
INSTALLATION RESTORATION PROGRAM (IRP) SITE INVESTIGATION REPORT FOR SITE NO. 12, AIRCRAFT PARKING APRON AREA

VOLUME I

152ND RECONNAISSANCE GROUP
NEVADA AIR NATIONAL GUARD
RENO-CANNON INTERNATIONAL AIRPORT
RENO, NEVADA

JUNE 1994

AIR NATIONAL GUARD READINESS CENTER
ANDREWS AFB, MARYLAND 20331



SOURCE: USGS 7.5' TOPOGRAPHIC MAP RENO QUADRANGLE (1982) / MT. ROSE NE QUADRANGLE (1982)

INSIDE FRONT COVER

RNO1-1ST

GEOGRAPHIC LOCATION MAP

152nd RG, Nevada Air National Guard

Reno, Nevada

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MARCH 1994

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1. Agency Use Only (Leave Blank)	2. Report Date	3. Report Type and Dates Covered

4. Title and Subtitle
INSTALLATION RESTORATION PROGRAM VOL I, II, III, IV
Site Investigation Report
152 TACTICAL FIGHTER GROUP, NEVADA AIR NATIONAL GUARD
RENO-CANNON INTERNATIONAL AIRPORT
RENO, NEVADA

5. Funding Numbers

6. Author(s)
OAK RIDGE NATIONAL LABORATORY
P.O. BOX 2567
GRAND JUNCTION, COLORADO 81502

7. Performing Organization Name(s) and Address(es)
OAK RIDGE NATIONAL LABORATORY
P.O. BOX 2567
GRAND JUNCTION, COLORADO 81502

8. Performing Organization Report number

9. Sponsoring/Monitoring Agency Name(s) and Address(es)
Hazardous Waste Remedial Action Program
Oak Ridge TN

Air National Guard Readiness Center
Andrews Air Force Base, Maryland 20331

10. Sponsoring/Monitoring Agency Report Number

11. Supplemental Notes

12. Distribution/Availability Statement
Approved for public release: distribution is unlimited

12b. Distribution Code

13. Abstract (maximum 200 words)
INSTALLATION RESTORATION PROGRAM SITE INVESTIGATION REPORT, Report of Finding of the Environmental Site Investigation of the Reno Air National Guard Base, Reno-Cannon International Airport, RENO, NEVADA.

By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

14. Subject Terms
Installation Restoration Program
RENO AIR NATIONAL GUARD BASE
RENO, NV

15. Number of Pages

16. Price Code

17. Security Classification of Report	18. Security Classification of this Page	19. Security Classification of Abstract	20. Limitation of Abstract
Unclassified	Unclassified	Unclassified	None

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89) Prescribed by ANSI Std. 239-18 298-102

EXECUTIVE SUMMARY

ES 1.0 INTRODUCTION

A Site Investigation (SI) was conducted at the Aircraft Parking Apron Area, Installation Restoration Program (IRP) Site No. 12 (also referred to as the Site), located at the 152nd Reconnaissance Group (RG), Nevada Air National Guard (NV ANG), Reno-Cannon International Airport, Reno, Nevada. The Site was not identified in the IRP Preliminary Assessment (PA) for the Base, but has been investigated as a result of fuel odors detected during the routine replacement of one of the concrete slabs at the aircraft parking apron at the Site. The field investigation conducted by Operational Technologies Corporation (OpTech) at the 152nd RG commenced on 25 October 1993 and was completed 6 January 1994.

ES 2.0 PREVIOUS INVESTIGATIONS

Two previous investigations have been conducted at or in the immediate area of the Site. PEER Consultants P.C. (PEER) conducted a Rapid Response Site Assessment (SA) in October, 1991 to investigate hydrocarbon contamination discovered during replacement of a portion of the aircraft parking apron. Oak Ridge National Laboratories (ORNL) conducted a SI at the Base from September 1992 through March 1993 to investigate seven IRP Sites identified during the Preliminary Assessment (PA). Of the seven sites ORNL investigated, IRP Sites Number 2, a former fire training area, and 7, the Petroleum, Oils and Lubricants (POL) Storage Facility are located either in or adjacent to IRP Site No. 12. IRP Site No. 2 is located in the northern portion of the Aircraft Parking Apron Area and IPR Site No. 7 is located adjacent to the southwest corner of the Aircraft Parking Apron Area.

ES 3.0 AIRCRAFT PARKING APRON

The Site is located at the southeast corner of the Base and is an open parking apron, approximately 360 feet in an east-west direction, by 1,020 feet in a north-south direction. There

are five areas, approximately 100 feet by 325 feet, where the aircraft are parked, serviced, and refueled.

ES 3.1 Investigative Findings

ES 3.1.1 Soil Vapor Survey

Benzene, toluene, ethlybenzene, and xylenes (BTEX); and total flame ionization detector (FID) volatile organic compounds (VOCs) were detected during the soil vapor survey. Maximum total BTEX detected was 2,848 micrograms per liter (μg/L), and maximum total FID VOCs detected were 103,370 μg/L. Contaminants were found under all five aircraft parking rows, in the general area of the former fire-training area, and in the immediate area of sampling point 31. Sampling point 31 is located in the middle of the western edge of the parking apron.

ES 3.1.2 Soil Contamination

Soil samples were submitted for analysis of VOCs, semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and lead. Groundwater samples were submitted for BTEX, SVOCs, TPH and lead analyses.

BTEX and TPH were detected in soil samples at IRP Site No. 12 at concentrations not exceeding Nevada Department of Conservation and Natural Resources (NDCNR) cleanup levels. However, borings were located a minimum of 2 feet from joints and cracks in the concrete to prevent damage to the parking apron. BTEX and TPH concentrations can be expected to be higher at these locations where contamination would more easily penetrate the concrete apron. It is noted TPH and benzene concentrations detected in soil samples collected during the PEER and ORNL investigations exceeded NDCNR cleanup levels.

Lead was detected in all soil samples submitted for laboratory analysis. The lead analyses reported were below the mean background concentration reported by ORNL.

ES 3.1.3 Groundwater Contamination

Lead was detected in water samples collected from all monitoring wells. A concentration of 0.055 ppm for the water sample collected from monitoring well MW08 during the first round of sampling (MW08-(1)), exceeded the federal drinking water standard of 0.05 ppm. The background concentration for lead in groundwater at the Site has not been determined.

ES 3.2 Microbiological Investigation

There is significant microbiological activity underneath the Site which correlates with contamination concentrations detected in soil samples. Total heterotrophs range from 405 to 11,000 colony forming units per gram (CFU/g). Hydrocarbon degraders were not present in the four samples analyzed.

ES 4.0 CONCLUSIONS

Soil gas survey results indicate VOC contamination is present in the subsurface at each of the five rows where aircraft are parked at the Site. Contaminant concentrations detected in soil samples collected during this SI did not exceed NDCNR cleanup levels. However, soil and groundwater samples collected during the PEER and ORNL investigations did exceed State cleanup levels.

Results of the microbiological investigation indicate that in-situ bioremediation techniques such as bioventing or bioaugmentation would be suitable for reducing hydrocarbon contamination in the soil. More information is needed to determine whether the addition of oxygen, nutrients, or the introduction of different strains of microorganisms are required to obtain optimum bioremediation at the Site.

ES 5.0 RECOMMENDATIONS

Based on the results of the SI conducted, the following recommendations are presented:

1. Prepare a Corrective Action Plan to collect soil samples and to delineate and remediate the soil, if required, during the replacement or removal of sections of the Aircraft Parking Apron.

2. Collect groundwater samples from background monitoring wells to determine background concentration of lead in groundwater at the Base.

3. Conduct quarterly groundwater sampling from monitoring well MW-08 for VOCs, SVOCs, and TPH. Lead should be analyzed during the first sampling event.

4. Conduct a treatability study to determine optimum bioremediation requirements for *in-situ* and *ex-situ* destruction of hydrocarbon contaminants in the soil below the aircraft parking apron.

5. Conduct a feasibility study to determine a cost effective remediation technology for *in-situ* or *ex-situ* destruction of hydrocarbon contaminants based on the quantity of soil to be treated.

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LIST OF ACRONYMS

ANG	Air National Guard
ANGRC	Air National Guard Readiness Center
ANGRC/CEVR	Air National Guard Readiness Center/Installation Restoration Program Branch
ARAR	Applicable or Relevant and Appropriate Requirement
ASG	Automated Sciences Group, Inc.
ASTM	American Society for Testing and Materials
ATHA	Ambient temperature headspace analysis
AWQC	Ambient Water Quality Criteria
BH	Borehole
BLS	Below land surface
BTEX	Benzene, toluene, ethylbenzene, xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CFU/g	Colony Forming Units per gram
CGI	Combustible gas indicator
CLP	Contract Laboratory Program
cm/sec	Centimeters per second
DD	Decision Document
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Office
ECAMP	Environmental Compliance Assessment and Management Program
EO	Executive Order
EPIR	Environmental Pollution Incident Report
F	Fahrenheit
FB	Field Blank
FD	Field Duplicate
FID	Flame ionization detector
FIRM	Flood Insurance Rate Map
FS	Feasibility Study
Ft	Feet
FTA	Fire Training Area

LIST OF ACRONYMS (Continued)

GC	Gas chromatograph
GW	Groundwater
HSA	Hollow-stem auger
ID	Inside diameter
IRP	Installation Restoration Program
JP-4	Jet fuel
LTM	Long-Term Monitoring
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goals
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
ml	Milliliter
MSL	Mean sea level
NDCNR	Nevada Department of Conservation and Natural Resources
NFA	No Further Action
NNHP	Nevada National Heritage Program
NOAA	National Oceanic and Atmospheric Administration
NV ANG	Nevada Air National Guard
OpTech	Operational Technologies Corporation
ORNL	Oak Ridge National Laboratory
PA	Preliminary Assessment
PID	Photoionization detector
POL	Petroleum, oils, and lubricants
PPE	Personal protective equipment
ppb	Parts per billion
ppm	Parts per million
psig	Pounds per square inch gauge
PVC	Polyvinyl chloride
PZ	Piezometer well
QA/QC	Quality assurance/quality control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act

LIST OF ACRONYMS (Concluded)

RD	Remedial Design
RG	Reconnaissance Group
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SA	Site Assessment
SARA	Superfund Amendments and Reauthorization Act of 1986
SI	Site Investigation
SOW	Statement of work
SPT	Standard penetration test
SS	Soil sample
SVOCs	Semivolatile organic compound
TCLP	Toxic Characteristic Leaching Procedure
TES	Target Environmental Services
TPH	Total Petroleum Hydrocarbons
µg/kg	Micrograms per kilogram
ug/L	Micrograms per liter
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UST	Underground storage tank
UTA	Unit Training Assembly
VOA	Volatile Organic Analysis
VOCs	Volatile Organic Compounds

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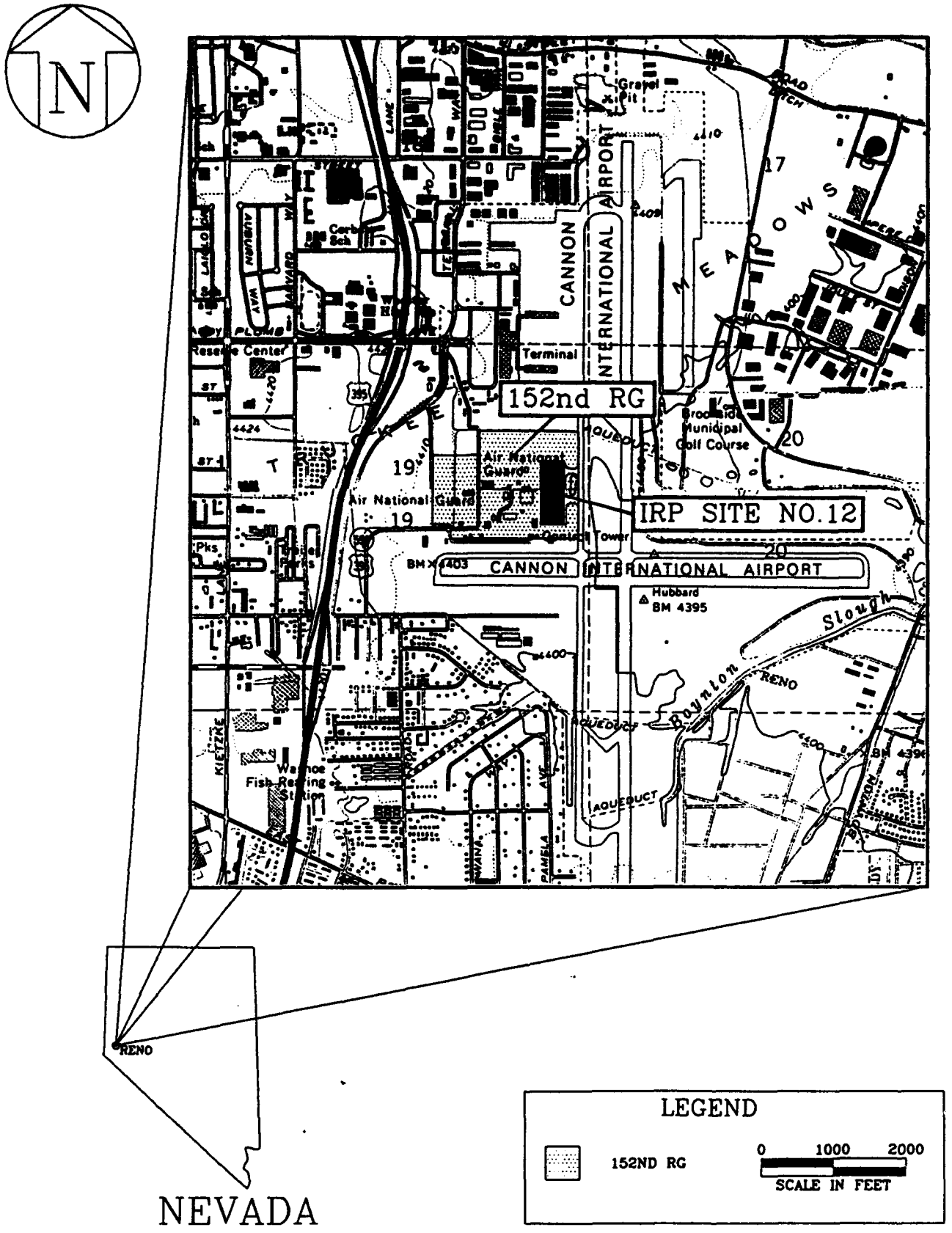
SECTION 1.0 INTRODUCTION

This Site Investigation (SI) report presents the results of the investigation activities conducted at the Aircraft Parking Apron Area, Installation Restoration Program (IRP) Site No. 12 (also referred to as the Site) located at the 152nd Reconnaissance Group (RG), Nevada Air National Guard (NV ANG), Reno-Cannon International Airport, Reno, Nevada (Figure 1.1). The site was not identified in the IRP Preliminary Assessment (PA) for the base, but was investigated as a result of fuel odors detected during the routine replacement of one of the concrete slabs at the site. Consequently, the site was identified, designated as IRP Site No. 12, and recommended for further investigation under the IRP.

The Air National Guard Readiness Center/Installation Restoration Program (ANGRC/CEVR) authorized Operational Technologies Corporation (OpTech) to prepare an SI work plan and conduct the SI at the Aircraft Parking Area. This investigation was conducted as outlined in the SI Work Plan submitted to the ANGRC/CEVR and the Nevada Department of Conservation and Natural Resources (NDCNR) in October 1993, and approved in October 1993.

1.1 INSTALLATION RESTORATION PROGRAM

The Defense Environmental Restoration Program (DERP) was established in 1984 to promote and coordinate efforts for the evaluation and cleanup of contamination at Department of Defense (DoD) installations. On 23 January 1987, Presidential Executive Order (EO) 12580 assigned specific responsibility to the Secretary of Defense for carrying out DERP within the overall framework of the Superfund Amendments and Reauthorization Act (SARA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. The IRP was established under DERP to identify, investigate, and clean up contamination at DoD installations. The IRP focused on cleanup of contamination associated with past DoD activities to ensure that threats to public health were eliminated and natural resources were restored for future use. Within the Air National Guard (ANG), ANGRC/CEVR manages the IRP and related activities.



SOURCE: USGS 7.5' TOPOGRAPHIC MAP RENO QUADRANGLE (1982) / MT. ROSE NE QUADRANGLE (1982)

FIGURE 1.1 RNO1-1ST	GEOGRAPHIC LOCATION MAP 152nd RG, Nevada Air National Guard Reno, Nevada	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION 14 JUL 1993

The IRP is divided into six phases, as illustrated in Figure 1.2 and defined and described in the following subsections.

1.1.1 Preliminary Assessment (PA)

The PA process consists of personnel interviews, a records search, and site inspections designed to identify and evaluate past disposal and/or spill sites that might pose a potential and/or actual hazard to public health, public welfare, or the environment. Previously undocumented information is obtained through the interview process. The records search focuses on obtaining useful information from aerial photographs; installation plans; facility inventory documents; lists of hazardous materials used; subcontractor reports; correspondence; Material Safety Data Sheets; Federal/State agency scientific reports and statistics; Federal administrative documents; Federal/State records on endangered species, threatened species, and critical habitats; documents from local government offices; and numerous standard reference sources.

1.1.2 Site Investigation (SI)

The SI phase consists of field activities designed to confirm the presence or absence of contamination at the potential sites identified in the PA or during non-related IRP investigations, and to provide data needed to reach a decision point for the site. The activities undertaken during the SI generally fall into three distinct categories: screening, confirmation, and optional activities.

Screening Activities

Screening activities are conducted prior to drilling activities to gather preliminary data on each site. Screening activities may include the use of such tools as a magnetometer survey to locate underground lines, tanks, and utilities; soil vapor surveys for developing the optimum number and location of soil borings needed to delineate soil contamination, and to be used as a guide in the selection of monitoring well locations; or the installation

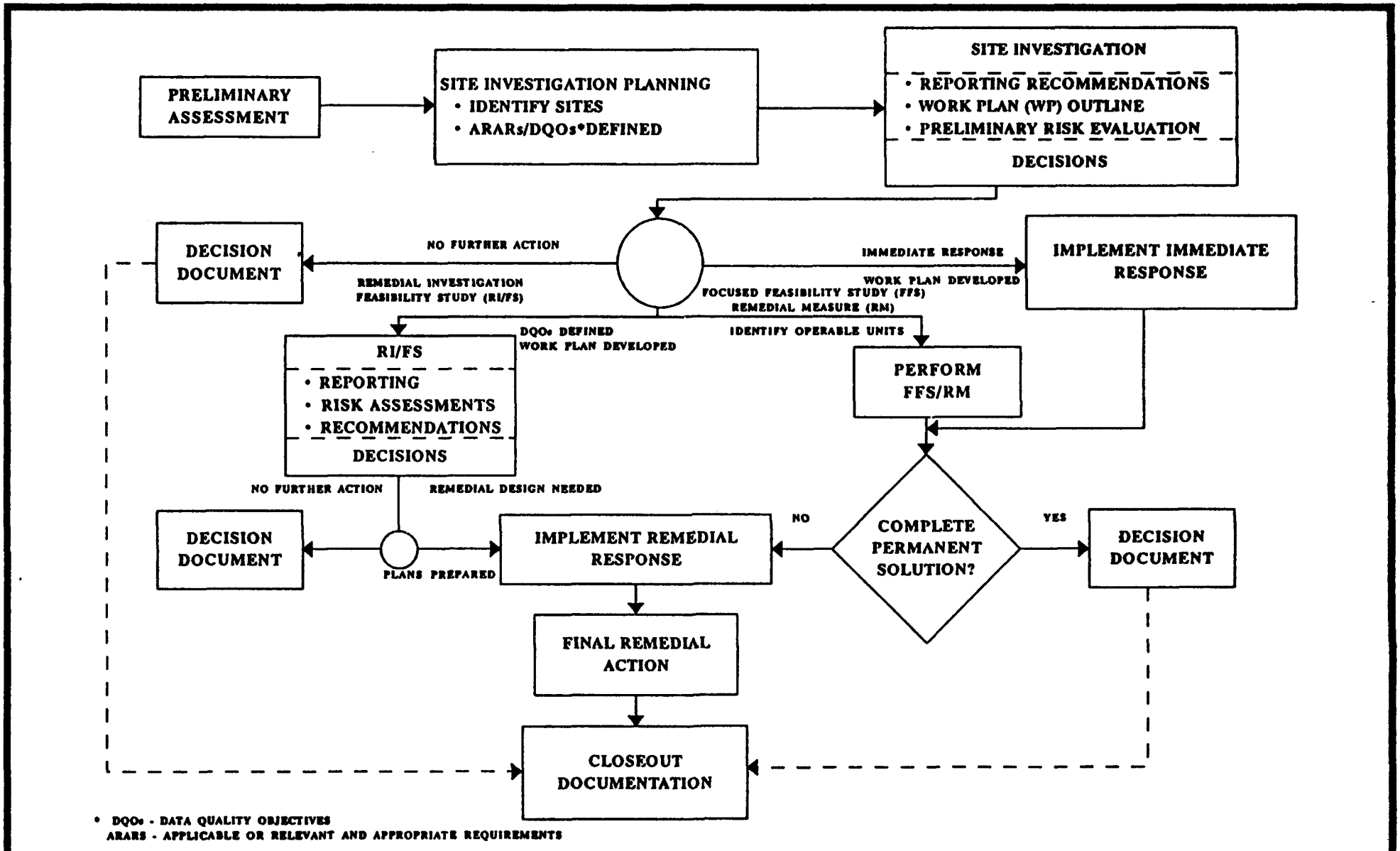


FIGURE 1.2

R:\RENO\FLOW-IRP

FLOW OF INSTALLATION RESTORATION PROGRAM TASKS

152nd RG, Neveda Air National Guard

Reno, Nevada

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of a piezometer network in order to determine groundwater flow direction prior to installation of any groundwater monitoring wells.

Confirmation Activities

Confirmation activities include the installation of soil borings and/or monitoring wells; specific media sampling; and laboratory analysis to confirm either the presence or the absence of contamination, levels of contamination, and the potential for contaminant migration. Information obtained during the subsurface investigation is also utilized to define the installation and site hydrology, geology, and soil characteristics.

Optional Activities

Optional activities are used if additional data are needed to reach a decision point for a site, such as no further IRP action is warranted, prompt removal of contaminants is necessitated, or further IRP work is required. Optional activities may include increasing the number of soil vapor sampling points or the number of soil borings and/or monitoring wells to be drilled.

The general approach for the design of the SI activities is to sequence the field activities so that data are acquired and used as the field investigation progresses. This is done in order to determine the absence or presence of contamination in a relatively short period of time, optimize data collection and data quality, and to keep costs to a minimum. Information, data, and analytical results obtained from the SI field investigation will support the selection of one of the following decisions:

No Further Action (NFA) – Investigation did not indicate harmful levels of contamination that pose a significant threat to human health or the environment. Therefore, no further IRP action is warranted and a Decision Document (DD) will be prepared to close out the site.

Immediate cleanup/remedial activities – Investigation indicates that the site poses an immediate threat to public health or the environment. Therefore, prompt removal of contaminants or measures to reduce contaminant levels to an acceptable limit is warranted.

Remedial Investigation/Feasibility Study (RI/FS) – Investigation indicates further IRP work is required and the next phase of the IRP needs to be implemented. The RI is described more fully in the following subsection.

1.1.3 Remedial Investigation (RI)

The objectives of the RI are to determine the nature and extent of contamination at a site, determine the nature and extent of the threat to human health and the environment, and to provide a basis for determining the types of response actions to be considered (decision document, feasibility study, remedial design, remedial action).

The RI consists of field activities designed to quantify and identify the potential contaminant, the extent of the contaminant plume, and the pathways of contaminant migration. Field activities may include the installation of soil borings and/or monitoring wells, and the collection and analysis of water, soil, and/or sediment samples. Careful documentation and quality control procedures in accordance with CERCLA/SARA guidelines ensure the validity of data. Hydrogeologic studies are conducted to determine the underlying strata, groundwater flow rates, and direction of contaminant migration.

A baseline risk assessment may be conducted which provides an evaluation of the potential threat to human health in the absence of remedial action. The assessment provides the basis for determining whether remedial action is necessary, the justification for performing remedial actions, and what imminent and substantial endangerment to public health or the environment exists.

The findings from these studies result in the selection of one or more of the following options:

NFA – Investigations do not indicate harmful levels of contamination that pose a significant threat to human health or the environment. Therefore, no further IRP action is warranted and a DD will be prepared to close out the site.

Long-Term Monitoring (LTM) – Evaluations do not detect sufficient contamination to justify costly remedial actions. LTM may be recommended to detect the possibility of future problems.

Feasibility Study (FS) – Investigation confirms the presence of contamination that may pose a threat to human health and/or the environment, and some sort of remedial action is indicated. The FS is described more fully in the following subsection.

1.1.4 Feasibility Study (FS)

Based on results of the RI, the baseline risk assessment, and a review of State and Federal regulatory requirements, an FS will be prepared to develop, screen, and evaluate alternatives for remediation of groundwater and/or soil contamination at the subject sites. The overall objective of the FS is to provide information necessary for remedial alternatives development. The FS is conducted to support selection of a remedy that: is protective of human health and the environment; attains applicable or relevant and appropriate requirements (ARARs); satisfies the preference for treatment that significantly and permanently reduces toxicity, mobility, or volume of hazardous constituents as a principal element; is cost-effective.

Activities associated with the FS include the following:

- development of alternatives;
- preliminary screening of remedial alternatives;
- detailed analysis of alternatives;

- comparative analysis of alternatives; and
- the creation of an FS report.

The end result of the FS is the selection of the most appropriate remedial action with concurrence by State and/or Federal regulatory agencies.

1.1.5 Remedial Design (RD)

The RD involves formulation and approval of the engineering designs required to implement the selected remedial action identified in the FS.

1.1.6 Remedial Action (RA)

The RA is the actual implementation of the remedial alternative. It refers to the accomplishment of measures to eliminate the hazard or, at a minimum, reduce it to an acceptable limit. Covering a landfill with an impermeable cap, pumping and treating contaminated groundwater, installing a new water distribution system, and *in-situ* biodegradation of contaminated soils are examples of remedial measures that might be selected. In some cases, after the RAs have been completed, an LTM system may be installed as a precautionary measure to detect contaminant migration or to document the efficiency of remediation.

1.1.7 Immediate Action Alternatives

At any point, environmental managers may determine that a former waste disposal site poses an immediate threat to public health or the environment, thus necessitating prompt removal of the contaminants. Immediate action, such as limiting access to the site, capping or removing contaminated soils, and/or providing an alternate water supply may suffice as effective control measures. Sites requiring immediate removal action maintain IRP status in order to determine the need for additional remedial planning or LTM. Removal measures or other appropriate remedial actions may be implemented during any phase of an IRP project.

SECTION 2.0 FACILITY BACKGROUND INFORMATION

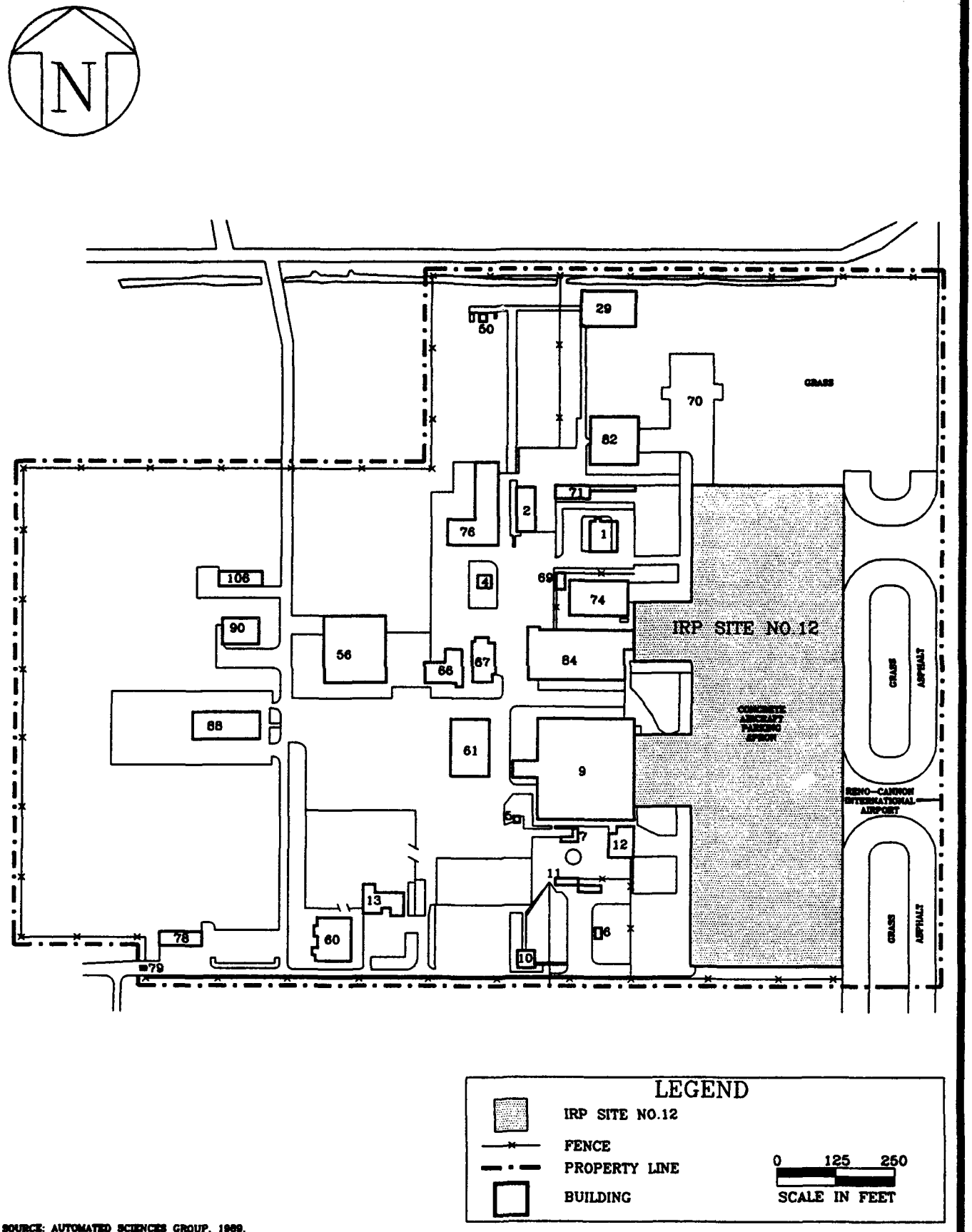
2.1 FACILITY DESCRIPTION

The 152nd RG, NV ANG, is located at the Reno-Cannon International Airport, East half, Section 19, Township 19N, Range 20E, Washoe County, Reno, Nevada. The airport is a county-owned facility located between McCarran Boulevard and Highway 395 in the southeastern section of Reno, Nevada. The Base occupies approximately 60 acres in the southern portion of the northwest quadrant of the airport complex and is completely fenced with controlled access. The population of the Base, including Unit Training Assembly (UTA), is approximately 1,200 people. There are 287 full-time Base personnel. Figure 2.1 shows the layout and boundaries of the Base. The Base receives its gas and electric service from Sierra-Pacific Power Company and water from Westpac Utilities. There are no active or abandoned water supply wells on the property. The closest public water well is approximately 4,000 feet north of the airport.

2.1.1 Base History

On April 12, 1948, the NV ANG initially established the 192nd Fighter Squadron. The unit designation was changed to the 192nd Fighter Bomber Squadron on April 9, 1951. In June 1955, the unit was redesignated as the 192nd Fighter Interceptor Squadron and maintained this designation until April 19, 1958, when the unit was renamed as the 152nd Fighter Group. In February 1961, the 152nd Fighter Group was redesignated as the 152nd Tactical Reconnaissance Group. In May 1993, the unit was redesignated the 152nd Reconnaissance Group.

When the 192nd Fighter Squadron was initially established, it was equipped with the P-51 aircraft and was located at the Stead Army Air Base, Reno, Nevada. In 1953, the NV ANG leased 29 acres of land at Hubbard Field (Reno-Cannon International Airport) from the city of Reno, Nevada. Base operations were moved from Stead to the present location in 1954.



SOURCE: AUTOMATED SCIENCES GROUP, 1989.

FIGURE 2.1

BASE MAP
152nd RG, Nevada Air National Guard
Reno, Nevada

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Operations at the Base have utilized numerous types of both piston and turbine aircraft throughout its history. Mission aircraft included the RF-86 reconnaissance aircraft from 1956 to 1965, the RB-57 reconnaissance aircraft and bomber from 1961 to 1965, the RF-101 reconnaissance aircraft from 1965 to 1975, and the RF-4C, which is the current reconnaissance mission aircraft. In addition, two C-12 cargo aircraft are presently operating at the base.

2.1.2 Adjacent Land Use

The land use south and west of the Base is industrial and residential. Immediately east and north of the Base is the Reno-Cannon International Airport.

2.1.3 Waste Disposal Practices

The 152nd RG is currently responsible for the maintenance and upkeep of approximately 20 RF-4C reconnaissance aircraft and two C-12 cargo planes. Operations involve aircraft maintenance and fuels management, as well as support activities, including aircraft inspection and ground vehicle maintenance. The major operations of the Base that have historically used and disposed of hazardous materials or hazardous wastes include aircraft maintenance, aerospace ground equipment maintenance, ground vehicle maintenance, POL management and distribution, and air weapons control. Aircraft support operations involve such activities as corrosion control, nondestructive inspection, fuel cell maintenance, engine maintenance, hydraulics, structure repair, and wheel and tire maintenance. Waste oils, recovered fuels, paint wastes, spent cleaners, acids, strippers, and solvents are generated and disposed of by these activities.

Oil/water separators are used at the Base to catch and separate oil from water to prevent the oil from entering the sanitary sewer system. The Base is currently connected to the City of Reno sanitary sewer system. Wastes that pass through the sanitary sewer system are treated at the Reno-Sparks treatment facility and the treated wastewater is discharged into the Truckee River. There are no past or present landfills, radioactive burial sites, or sludge burial sites on the Base.

2.2 PREVIOUS INVESTIGATIONS

2.2.1 Automated Sciences Group, Inc. PA

A preliminary assessment was conducted by Automated Sciences Group, Inc. (ASG), Oak Ridge, Tennessee, in 1988. As a result of this assessment, seven sites were identified as potentially contaminated with hazardous materials/hazardous wastes and were considered to have the potential for contaminant migration. These sites included six fire-training areas, and a POL storage area. Details of subsequent investigation by ORNL on two of the sites identified in the PA, Site No. 2 (Fire-Training Area No. 2) and Site No. 7 (POL Storage Facility) are pertinent to the SI investigation for IRP Site No. 12 and are discussed in Sections 2.2.3.1 and 2.2.3.2.

2.2.2 PEER Investigation

In October, 1991, PEER Consultants, P.C. (PEER) conducted a Site Assessment (SA) in response to fuel odors detected during the routine replacement of one of the concrete slabs which make up the aircraft parking apron. The replaced slab is located approximately 360 feet from the northeast corner of Building 9, and approximately 280 feet from the northeast corner of Building 12, encompassing an area of approximately 50 feet in length and 50 feet in width (Figure 2.2).

Three soil borings were drilled to collect 15 soil samples for analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX), and total petroleum hydrocarbons (TPH). Soil samples were analyzed for BTEX using USEPA Method SW8240 and TPH as JP-4 using California modified 8015. Groundwater monitoring wells MW1, MW2, and MW3 were installed in the borings. Groundwater samples were collected and analyzed for BTEX using USEPA Method 624 and TPH as JP-4 using California modified 8015 (PEER, 1992).

Laboratory analyses of soil samples reported are shown in Table 2.1. TPH concentrations ranged from 1,000 to 2,800 milligrams per kilogram (mg/kg), with the highest concentrations detected in the first foot of soils sampled immediately beneath the concrete apron. BTEX ranged

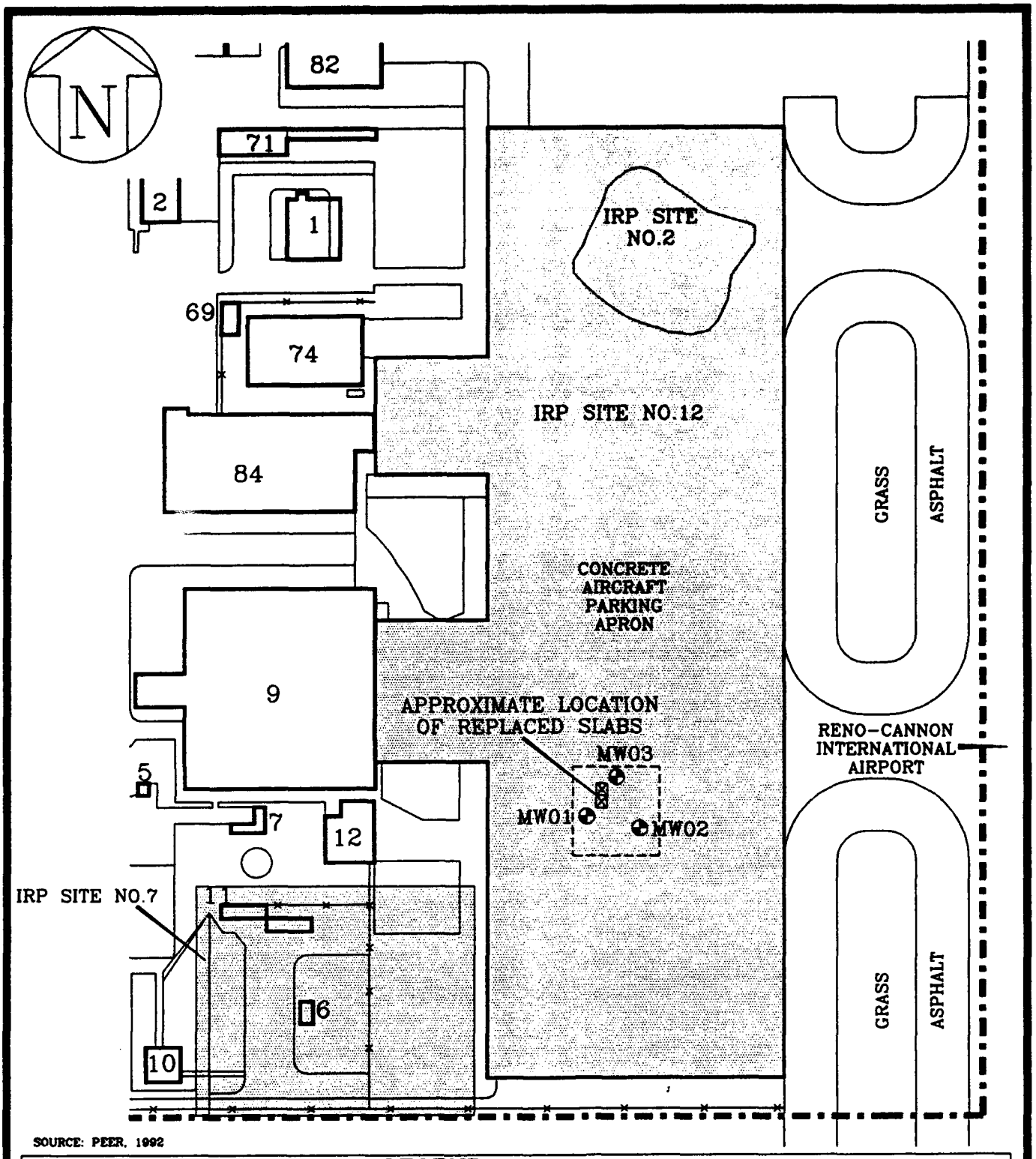

FIGURE 2.2

PEER SITE ASSESSMENT AREA
SOIL BORING/MONITORING WELL LOCATIONS
152nd RG, Nevada Air National Guard
Reno, Nevada

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Table 2.1
BTEX and TPH Laboratory Results For Soil Samples, Rapid Response SA
152nd RG, Nevada Air National Guard, Reno, Nevada

Soil Boring/ Monitoring Well	Depth (feet BLS)	TPH (mg/kg)	Benzene (µg/kg)	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Xylenes (µg/kg)
MW1	1.0 - 2.0	2,800	620	ND	6,700	11,000
	2.0 - 3.5	410	ND	ND	ND	ND
	5.0 - 6.5	ND	ND	ND	ND	ND
	6.5 - 8.0	ND	ND	ND	ND	ND
	8.0 - 9.5	–	–	–	–	–
	9.5 - 10.5	ND	ND	ND	ND	ND
	13.0 - 14.5	–	–	–	–	–
MW2	1.0 - 2.0	1,000	ND	ND	1,300	2,800
	2.0 - 3.5	900	ND	ND	700	1,600
	3.5 - 5.0	210	ND	ND	ND	ND
	5.5 - 6.5	75	ND	ND	20	57
	6.5 - 8.0	ND	ND	ND	ND	ND
	8.0 - 9.5	ND	ND	ND	ND	ND
	14.0 - 15.5	–	–	–	–	–
MW3	1.0 - 2.0	ND	ND	ND	ND	ND
	3.5 - 5.0	–	–	–	–	–
	5.0 - 6.5	–	–	–	–	–
	6.5 - 8.0	ND	ND	ND	ND	ND
	9.5 - 11.0	ND	ND	ND	ND	ND
NDCNR action levels		100	500	100,000	70,000	1,000,000

SA – Site Assessment.
BLS – Below land surface.
TPH – Total petroleum hydrocarbons.
ND – Not detected at or below the method detection limit.
– Not analyzed.
mg/kg – milligrams per kilogram.
µg/kg – micrograms per kilogram.
Source: PEER, 1992.

from 77 to 18,320 micrograms per kilogram (μg/kg). The data indicated that the concentration of petroleum contaminants decreased with depth to levels below the detection limit of the analysis methods.

Laboratory analyses of groundwater samples reported are shown in Table 2.2. Benzene and toluene were not detected in groundwater samples analyzed. Total xylenes and ethylbenzene were detected in samples from monitoring wells MW1 and MW2 at concentrations ranging from 2 to 4 micrograms per liter (μg/L) for total xylenes and 1 to 2 μg/L for ethylbenzene (PEER, 1992).

The locations of IRP sites on the Base are shown in Figure 2.3. Sites No. 1 and No. 6 are not located on Base property and are not included in the figure. Site No. 1 is located approximately 2,500 feet southwest of the Base and approximately 600 feet east of Runway 34L. Site No. 6 is located approximately 3,600 feet southwest of the Base, approximately 2,200 feet east of Runway 34L, and 800 feet south of Runway 25.

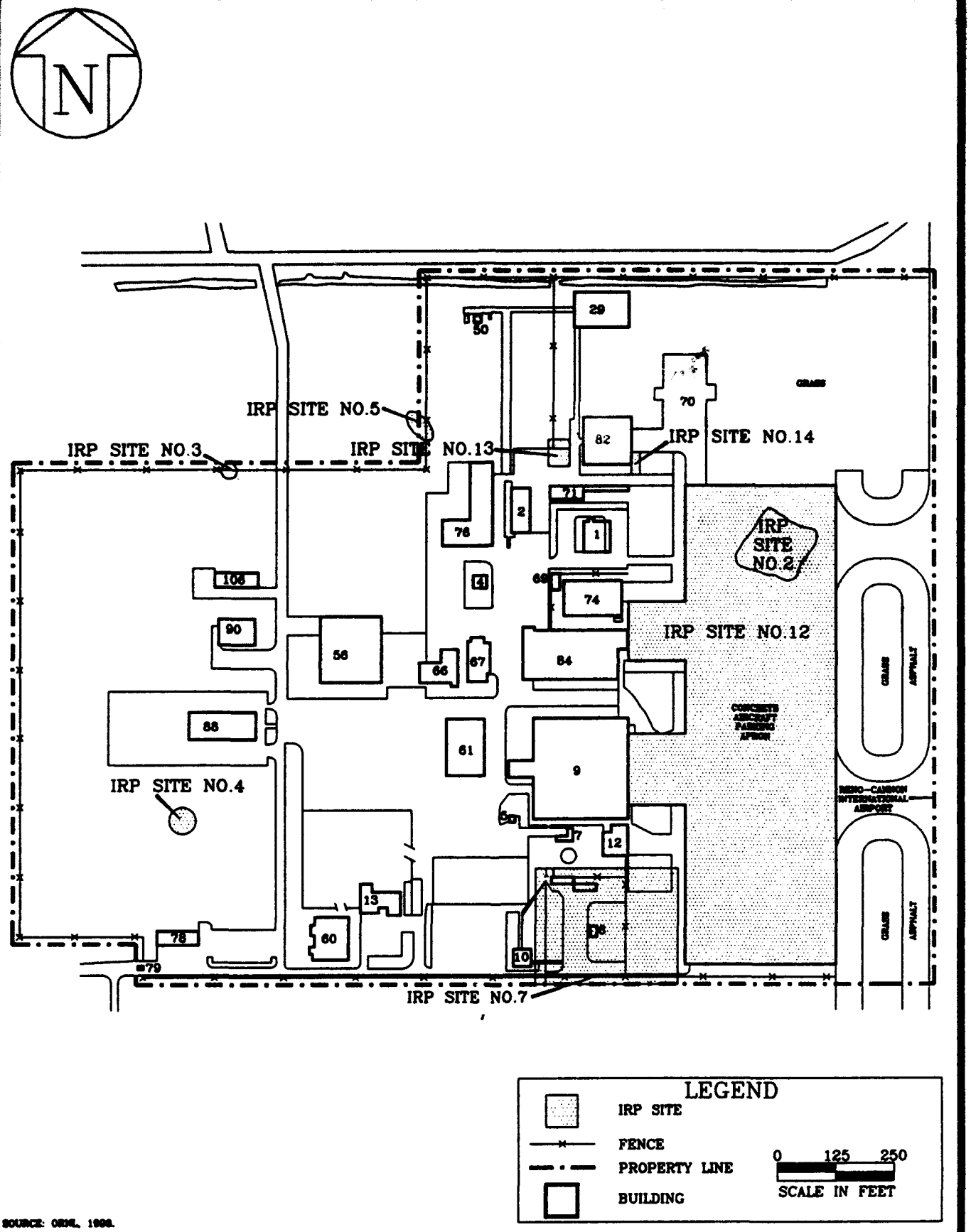
2.2.3 Oak Ridge National Laboratory SI

Oak Ridge National Laboratory (ORNL) conducted an SI from September 1992 to March 1993 at IRP Sites No. 2, No. 3, No. 4, No. 5, No. 7, No. 13, and No. 14 at the Base. Site No. 2 is in the northern portion of Site No. 12, and Site No. 7 is adjacent to the southwest corner of Site No. 12. The locations of monitoring wells and soil borings installed by ORNL in the immediate vicinity of IRP Site No. 12 are presented on Figure 2.4.

Table 2.2
BTEX and TPH Laboratory Results For Groundwater Samples, Rapid Response SA
152nd RG, Nevada Air National Guard, Reno, Nevada

Monitoring Well	TPH (mg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)
MW1	2	ND	ND	1	2
MW2	ND	ND	ND	2	4
MW3	ND	ND	ND	ND	ND
NDCNR action levels	NA	5	100	70	1,000

SA – Site Assessment.
TPH – Total petroleum hydrocarbons.
ND – Not detected at or below the method detection limit.
NA - Non-applicable
mg/L – milligrams per Liter.
µg/L – micrograms per Liter.
Source: PEER, 1992.



SOURCE: OESE, 1988.

FIGURE 2.3

IRP SITES LOCATED ON BASE
152nd RG, Nevada Air National Guard
Reno, Nevada

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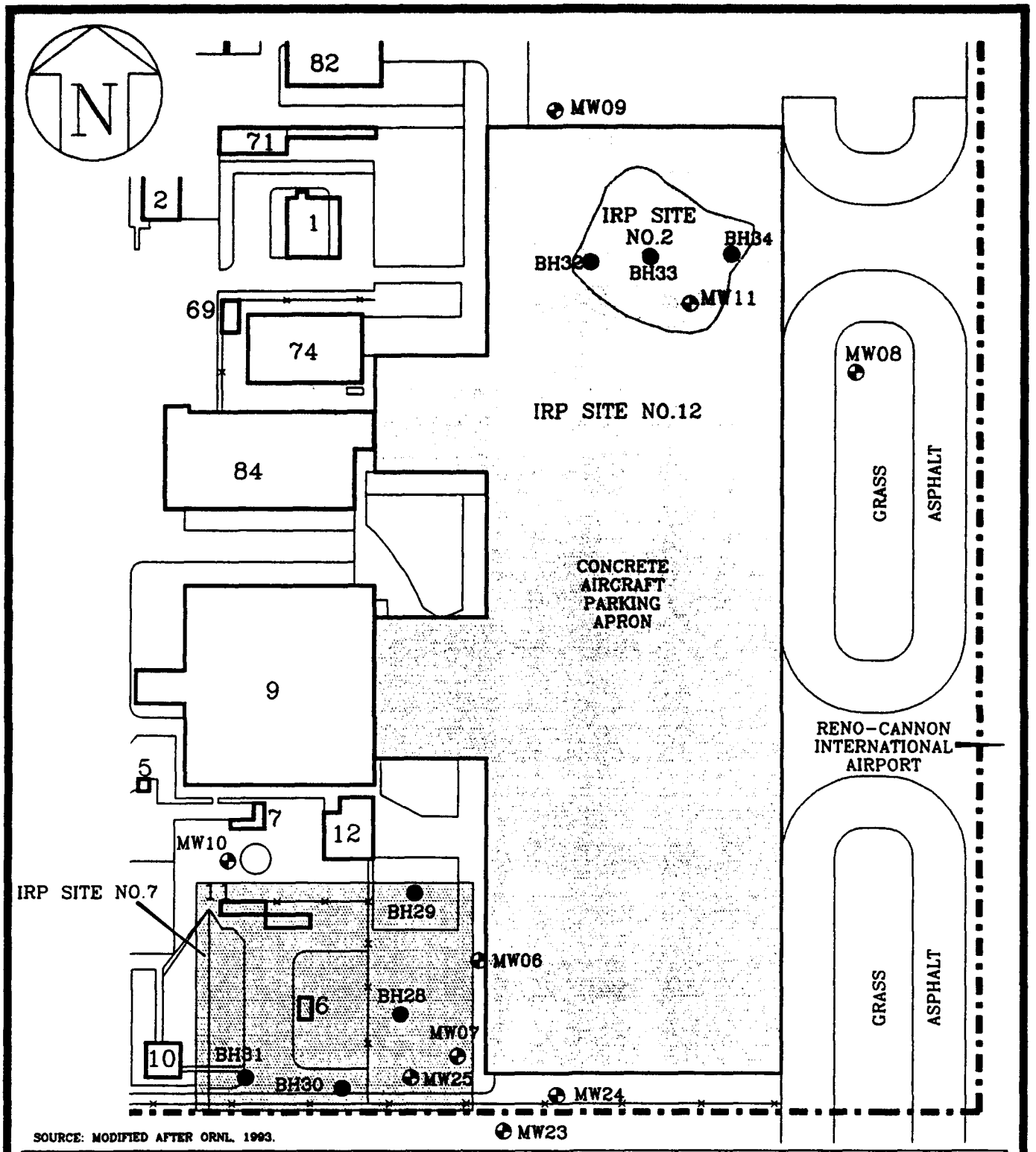

FIGURE 2.4

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ORNL SITE ASSSESSMENT AREA
SOIL BORING/MONITORING WELL LOCATIONS
152nd RG, Nevada Air National Guard
Reno, Nevada

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2.2.3.1 IRP Site No. 2

IRP Site No. 2 was a former Fire Training Area 2 (FTA-2) from 1956 to 1960, which is now located under the northern portion of the Aircraft Parking Apron. Three soil borings (BH32, BH33, and BH34) were drilled to collect soil samples for analysis of Volatile Organic Compounds (VOCs), and TPH as JP-4. Groundwater samples were collected from monitoring wells MW08, MW09, and MW11 and analyzed for VOCs and TPH as JP-4. Both soil and groundwater samples were analyzed for VOCs using USEPA Contract Laboratory Program (CLP) Volatiles Statement of Work (SOW) Method. The data was reported as USEPA Level III data. Both soil and groundwater samples were analyzed for TPH as JP-4 using California modified 8015 (ORNL, 1993).

Laboratory analysis of soil samples reported are shown on Table 2.3. TPH concentrations detected ranged from 0.17 to 84.69 mg/kg. BTEX concentrations detected ranged from 12 to 40 μg/kg. TPH data indicated that the concentration of petroleum contaminants decreased with depth. Laboratory analysis results of groundwater samples reported are shown on Table 2.4. BTEX and TPH were not detected in groundwater samples analyzed.

2.2.3.2 IRP Site No. 7

IRP Site No. 7, the POL storage facility, is located immediately west of the southwest corner of the site. Aviation fuel for the Base is supplied by four 25,000-gallon underground storage tanks (USTs) located at the POL storage facility. Three soil borings (BH29, BH30, and BH31) were drilled to collect soil samples for analysis of volatiles and TPH as JP-4. Groundwater samples were collected from monitoring wells MW06, MW07, MW10, MW23, MW24, and MW25 and analyzed for VOCs, and TPH as JP-4. Both soils and groundwater were analyzed for VOCS using USEPA CLP SOW Method. The data was reported as USEPA Level III Data. Both soils and groundwater were analyzed for TPH as JP-4 using California modified 8015 (ORNL, 1993).

Table 2.3
BTEX and TPH Laboratory Results For Soil Samples, ORNL SI for IRP Sites No. 2 And No. 7 152nd RG, Nevada Air National Guard, Reno, Nevada

Soil Boring	Depth (feet BLS)	TPH (mg/kg)	Benzene (µg/kg)	Toluene (µg/kg)	Ethylbenzene (µg/kg)	Xylenes (µg/kg)	Sample Date
BH27/MW25	1.5 - 2.0	2,500	ND	ND	ND	44,000	12-06-92
	4.5 - 5.0	87 33*	3J 2J*	7J ND*	50 120*	280 420*	12-06-92
BH28	1.5 - 2.0	9.6J	19	39	94	200	12-06-92
	4.5 - 5.0	590	14J	140	320	1,500	12-06-92
	7.5 - 8.0	1,600	ND	520J	1,100J	5,600	12-06-92
BH29	6.5 - 7.0	0.06J	ND	ND	ND	ND	12-06-92
BH30	1.5 - 2.0	5.8	4J	ND	8J	56	12-06-92
	4.5 - 5.0	570	ND	ND	2,300	8,200	12-06-92
	7.5 - 8.0	3.1J	ND	ND	ND	5J	12-06-92
BH31	4.5 - 5.0	2,500 2,200*	ND 670*J	ND 3,900*	630J 24,000*	2,600 82,000*	12-06-92
	7.5 - 8.0	2,800	230J	ND	ND	1,400J	12-06-92
BH32	2.5 - 3.0	84.69	ND	ND	ND	ND	12-07-92
	4.5 - 5.0	1.83	ND	ND	ND	ND	12-07-92
BH33	4.5 - 5.0	12.43	ND	ND	17	13	12-07-92
	6.5 - 7.0	0.72	ND	ND	12	ND	12-07-92
BH34	2.5 - 3.0	0.17	ND	ND	ND	ND	12-07-92
NDCNR action levels		100	500	100,000	70,000	1,000,000	

BLS – Below land surface.
µg/kg – micrograms per kilogram.
TPH – Total Petroleum Hydrocarbons.
ND – Not detected at or below the method detection limit.
J - Reported value is below the contract required detection limit but above the instrument detection limit. Values are estimated.
Source: ORNL, 1993.
mg/kg - milligrams per kilogram.
* - Duplicated.

Table 2.4
VOC and TPH Laboratory Results For Groundwater Samples, ORNL SI For IRP Sites No. 2 And No. 7 152nd RG, Nevada Air National Guard, Reno, Nevada

Monitoring Well	TPH (mg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	Trichloroethene (µg/L)	1,2-Dichloroethene (µg/L)	Sample Date
MW06	0.56	21	6	4	63	ND	ND	12-06-92
MW07	28	2,300	ND	480	1,400	ND	ND	12-06-92
MW08	ND ND	ND ND	ND ND	ND ND	ND ND	6.0 2.0J	ND 18	12-02-92 03-07-93
MW09	ND	ND	ND	ND	ND	ND	ND	12-06-92
MW11	ND	ND	ND	ND	ND	ND	ND	12-06-92
MW23	ND	ND	2	ND	ND	ND	ND	12-06-92
MW24	ND	ND	2	ND	ND	ND	ND	12-16-92
MW25	2.6	620	7	ND	92	ND	ND	12-16-92
MCL	NA	5	1,000	700	10,000	5	5	

BLS – Below land surface.
TPH – Total Petroleum Hydrocarbons.
µg/L – micrograms per Liter.
Source: ORNL, 1993.
ND – Not detected at or below the method detection limit.
mg/L – milligrams per Liter.
MCL – Maximum contaminant level.
NA – Not applicable.
J - Reported value is below the contract required detection limit but above the instrument detection limit. Values are estimated quantities.

Laboratory analyses of soils samples reported are shown on Table 2.3. TPH concentrations detected ranged from 0.06 to 2,800 mg/kg. BTEX concentrations detected ranged from 5 to 110,570 μg/kg. The data indicates the highest concentration of contamination is near the water table. Laboratory analysis results of groundwater samples reported are shown on Table 2.4. Monitoring well MW07 had the highest reported BTEX and TPH concentrations, namely 4,180 μg/L for BTEX and 28 mg/L for TPH.

2.3 SITE DESCRIPTION

2.3.1 Location

The Aircraft Parking Apron Area, or site, is located at the southeast corner of the Base, located west of the N-S taxiway and north of taxiway "L" at the Reno-Cannon International Airport. The site is an open parking apron approximately 360 feet in an east-west direction, by 1,020 feet in a north-south direction. The southern two-thirds of the site is composed of 12- by 15-foot concrete slabs, while the newer, northern one-third is composed of 25- by 25-foot concrete slabs. There are five areas, approximately 100 feet by 325 feet, where the aircraft are parked, serviced, and refueled (Figure 2.5).

There are seven aboveground structures (Buildings 71, 1, 74, 84, 9, 12, and 6) located directly west of the site (Figure 2.3). Building 9 is an aircraft hangar, Building 84 is the squadron operations facility, and Building 6 is the POL storage facility. Additional buildings, including the airport operations tower, are located south of the site, off-base.

2.3.2 Site History

Between 1956 and 1960, FTA-2 (designated IRP Site No. 2), was located at the northern end of the site, approximately 350 feet east of Building 1 (Figure 2.3). This was prior to the northern one-third of the present-day Aircraft Parking Apron being constructed between 1959 to 1963. The northern one-third of the IRP Site No. 12 now covers FTA-2. The joints between concrete slabs were originally in-filled with material that was not resistant to the heat from the

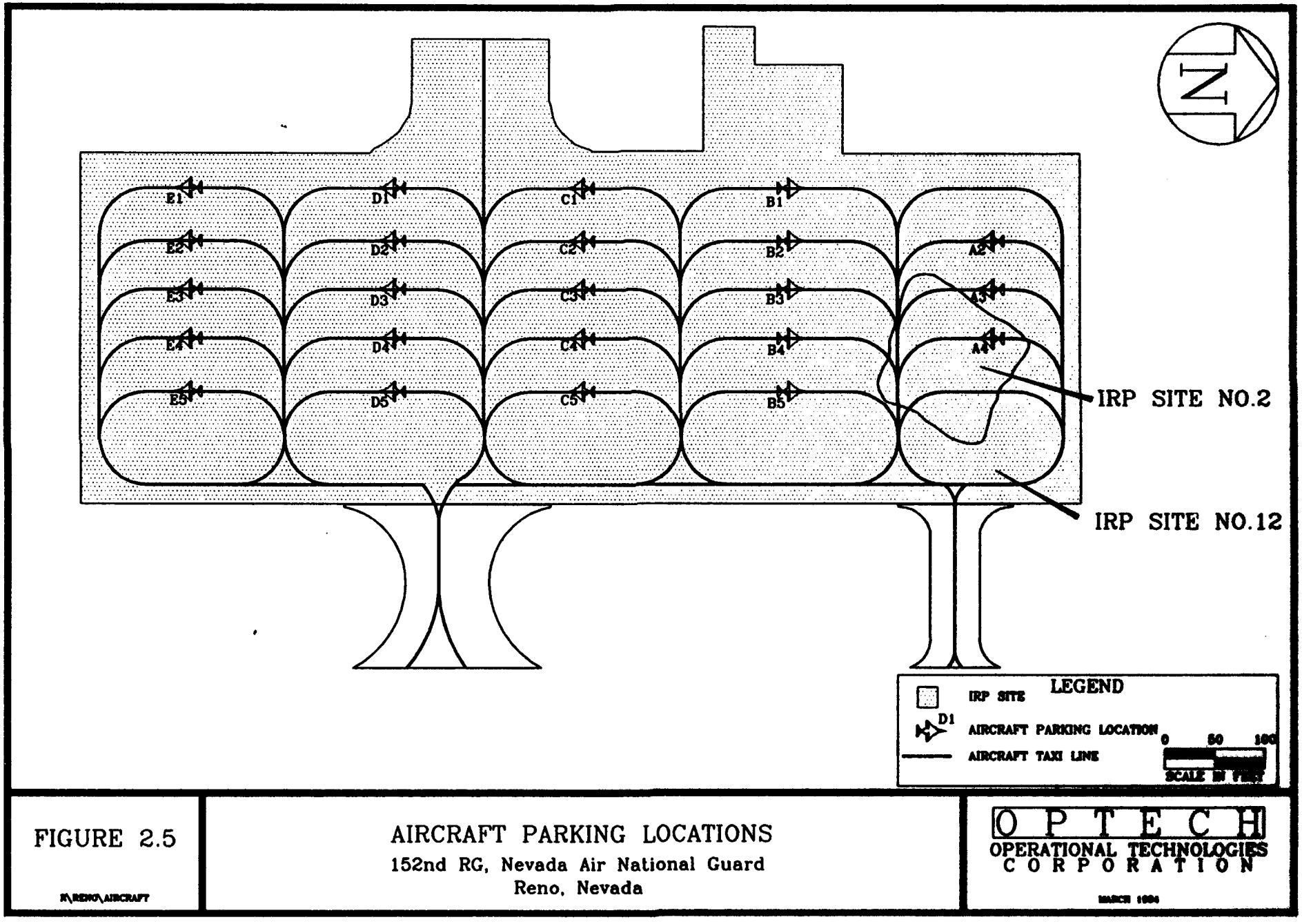

FIGURE 2.5

AIRCRAFT PARKING LOCATIONS
152nd RG, Nevada Air National Guard
Reno, Nevada

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jet exhaust. The erosion of this material may have created potential channels of contamination. The joints have now been in-filled by a heat resistant material (Knuf, 1993).

2.3.3 Release History

Two JP-4 spills were reported, one occurring in the 1970's and one in 1986. According to the Environmental Pollution Incident Report (EPIR), a spill of an estimated 40 gallons of JP-4 occurred at the south end of the parking apron on August 1, 1986. Records of spills were not required in the 1970's and no data is available for this time period. Numerous spills have been reported around the POL facility, mostly between 1973 to 1985. Fuel spills of up to 1,000 gallons have occurred in this area. Up until the early 1980's, most of these spills were flushed into the soil/gravel areas surrounding the refueling stand (ASG, 1989).

SECTION 3.0 ENVIRONMENTAL SETTING

3.1 TOPOGRAPHY

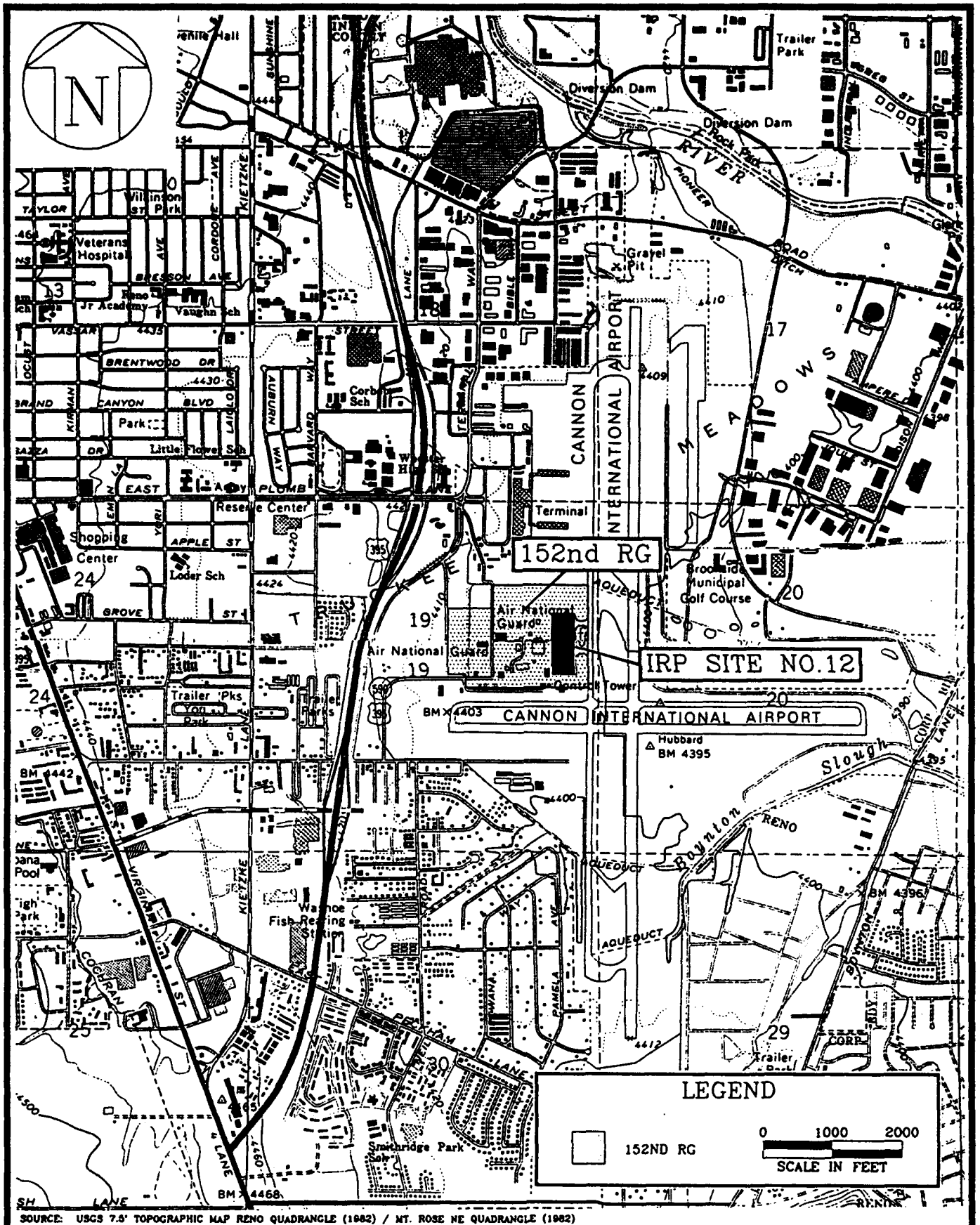
The 152nd RG is located on the Truckee Meadows, a north-trending, intermontane basin in western Nevada. "Truckee Meadows area" defines the topographic basin bordered on the west by the Carson Range, which is a spur of the Sierra Nevada mountains, on the east by the Virginia Range, on the north by units of these two ranges, and on the south by Pleasant Valley. The Truckee Meadows area lies along the western margin of the Great Basin section of the Basin and Range physiographic province. The cities of Reno and Sparks are the major communities in the Truckee Meadows area with a 1992 population of approximately 196,000.

The land surface at the Base is relatively flat, but gently slopes downward toward the east. The elevation of the Base is 4,400 feet above mean sea level (MSL). To the west, the Sierra Nevada mountains rise to elevations of 9,000 to 11,000 feet. Mountains to the east reach 6,000 to 7,000 feet. Topographic relief at the Base and in the immediate vicinity (one-half mile radius from the Base) ranges from 0 to 10 feet. A topographic map of the site is shown in Figure 3.1.

3.2 METEOROLOGY

The meteorological data presented below is from local climatological data compiled by the National Oceanic and Atmospheric Administration (NOAA, 1992), for Reno, Nevada. The recording station is NOAA station No. 26-6779, located near the Base on airport property (ASG, 1989).

The climate of the Reno area is characterized by mild temperatures and low rainfall. The average annual temperature for the Reno area is 50.0° Fahrenheit (F) (based on 1962-1991 data), ranging from 34.6° to 65.5°F. Temperatures may vary 45°F in a single day. The average annual precipitation is 7.58 inches for the same time period. The total precipitation at Reno-Cannon International Airport for 1992 was 5.3 inches. More than half of the annual



SOURCE: USGS 7.5' TOPOGRAPHIC MAP RENO QUADRANGLE (1982) / MT. ROSE NE QUADRANGLE (1982)

FIGURE 3.1 R\RENO\TOPO	7.5' TOPOGRAPHIC MAP 152nd RG, Nevada Air National Guard Reno, Nevada	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION JANUARY 1994

precipitation in Reno occurs as mixed rain and snow between the months of December and March. Summer rain occurs as brief thunderstorms in the middle and late afternoons.

The average annual evaporation from open water surfaces is 43 inches. Using the method outlined in the Federal Register (47 FR 31224, 16 July 1982), the annual net precipitation for the Base is -35.42 inches. Rainfall intensity based on the 1-year, 24-hour rainfall (47 FR 31235, 16 July 1982, Figure 8) is 1.5 inches (ASG, 1989).

3.3 GEOLOGY

The Truckee Meadow is a structural basin or graben bounded by the metamorphic Carson Range to the west and the metamorphic and igneous Virginia Range to the east. The valley is partly filled with unconsolidated and partially consolidated subaerial and lacustrine (lake) deposits. The ranges bordering the Truckee Meadows area are deeply dissected, complex, fault-block mountains that have been broken into troughs and ridges by normal faults. The foothill belts of these ranges are composed of complex faulted, steeply dipping stream and lacustrine deposits.

The subsurface geologic units of the valley fill consist of an estimated 2,800 to 4,000 feet of unconsolidated to partially consolidated material (Cohen and Loeltz, 1964). In ascending stratigraphic sequence are the Pliocene-aged Truckee Formation, the Pliocene and Pleistocene-aged older alluvium, and the Pleistocene-aged younger alluvium (Table 3.1).

The Truckee Formation is Pliocene in age; predominantly unconsolidated and partly consolidated diatomite, diatomaceous clay and silt, sand, gravel and tuff. The Truckee Formation overlies Triassic-aged igneous and metamorphic rocks. Permeability of the Truckee Formation is commonly low.

Lithologically, the older and younger alluvium are very similar. The distinction between the older and younger alluvium is as follows: (1) the younger alluvium is structurally undeformed, whereas the older alluvium is structurally deformed, (2) the younger alluvium is not appreciably

eroded and is largely restricted to the valley lowlands and stream channels, whereas the older alluvium forms a well-dissected rolling topography in the foothills bordering the valley floor, and (3) the younger alluvium is characterized by a weakly to moderately developed soil profile, whereas the older alluvium is characterized by a well-developed soil profile.

The older alluvium is Pliocene and Pleistocene in age and consists mostly of erosional debris derived from the surrounding mountains. It is poorly sorted, consisting of fine-grained lacustrine clay, silt, and sand; moderately to poorly sorted stream-channel deposits; and angular poorly sorted colluvium.

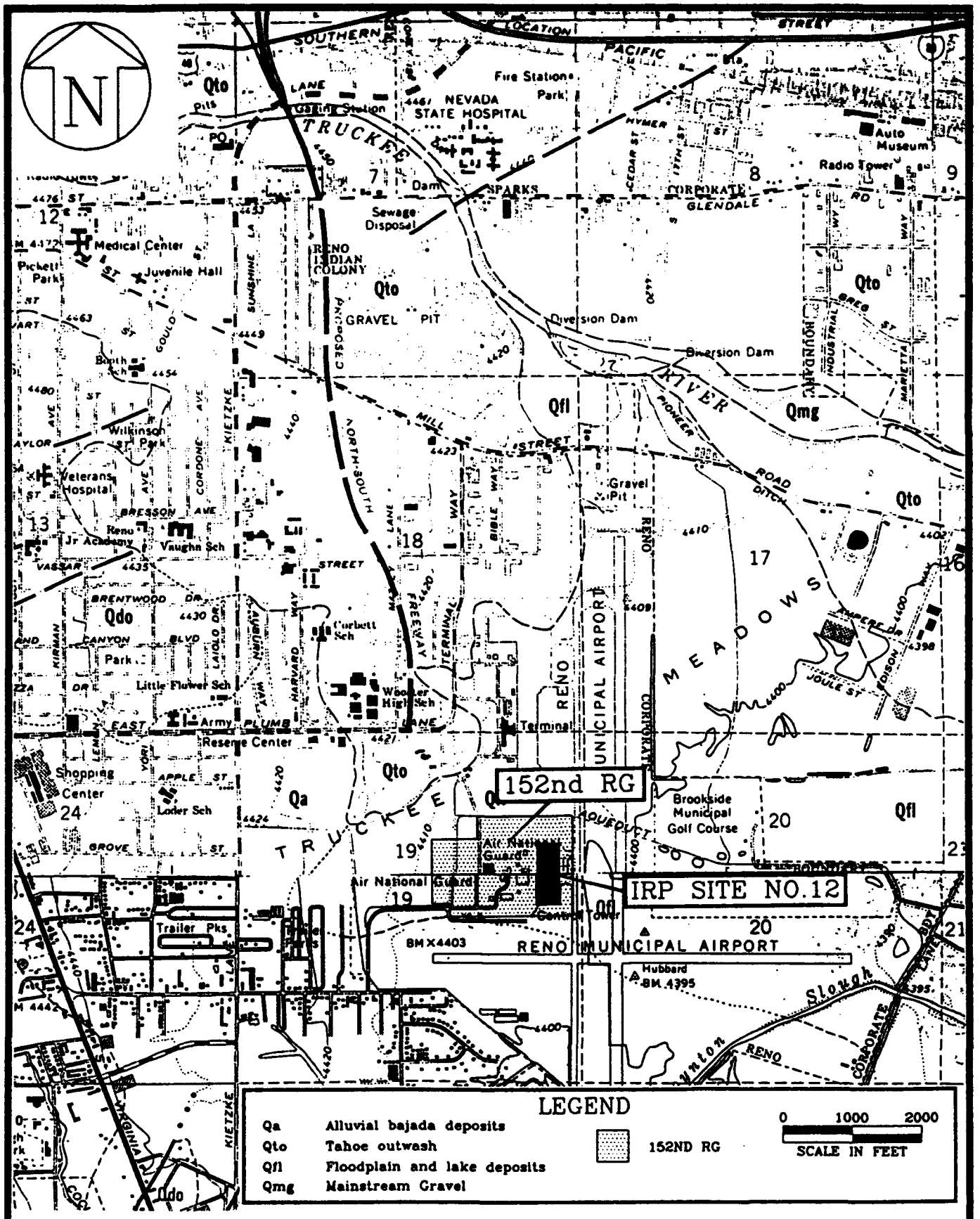
Table 3.1
Stratigraphic Section at the Base
152nd RG, Nevada Air National Guard, Reno, Nevada

System	Subdivisions	Thickness	Lithology
Quaternary	Younger Alluvium	0 - 175 feet	Fluviatile deposits of sands and gravels, and Lacustrine deposits of clays and silts.
———	Older Alluvium	0 - 65 feet	Sand and gravels.
Tertiary	Truckee Formation	0 - 100 feet	Diatomite, diatomaceous clay and silt, sand, gravel, and tuff.

Source: Cohen and Loeltz, 1964.

The younger alluvium is Pleistocene in age and unconformably overlies the older alluvium. It is composed of lacustrine deposits of clay, silt, and sand; coarse-grain fluviatile deposits; and fanglomerate. The Base is located on lacustrine deposits of the younger alluvium. These deposits are composed of clay and silt of low permeability and stringers of sand and gravels with moderate to high permeability.

A geologic maps of the Reno area (Figure 3.2) shows that the base lies on a Quaternary deposit termed "floodplain and lake deposits". Bonham and Rogers (1983), describe it as: Interbedded gray to pale grayish-yellow silt and fine sand; contains thin lenses of peat; fluvial and lacustrine deposits up to 7 meters (23 ft.) thick, with little or no soil development.



SOURCE: NEVADA BUREAU OF MINES AND GEOLOGY RENO AREA / MT. ROSE NE QUAD.

FIGURE 3.2

F:\RENO\GEO

GEOLOGIC MAP OF THE
RENO AREA
152nd RG, Nevada Air National Guard
Reno, Nevada

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The southern portion of the airfield is underlain by deposits described by Bonham and Rogers (1983), as: thin sheet-like aprons of fine- to medium-grained clayey sand and intercalated muddy, medium pebble gravel; deposits of low gradient streams that rework older gravelly outwash and alluvial fan deposits; weakly weathered and largely undissected. Little or no soil development.

Figure 3.3 shows the location of geologic cross sections across the site, constructed from ORNL and PEER monitoring well logs. Geologic cross sections are shown on Figures 3.4 through 3.6. These cross sections show the site is underlain by man-made deposits of clay, silt, and sand fill; and natural floodplain deposits (Bonham and Bingler, 1973). Thickness of these deposits vary from four to eight feet. Beneath these deposits are water-bearing, fine- to coarse grained sands with occasional interbedded layers of silts and clayey silts. Table 3.2 represents a well log from monitoring well MW24 located at the south end of the site.

Table 3.2
Well Log of Monitoring Well MW24
Showing Typical Shallow Stratigraphy at the Site
152nd RG, Nevada Air National Guard, Reno, Nevada

Lithology	Thickness (ft)	Depth From Surface to Bottom of Layer (ft)
Fill, sandy gravel	2.1	2.1
Silty clay and silt	1.5	3.6
Clay	4.4	8.0
Sand	1.0	9.0
Clayey silt	1.0	10.0
Sand, poorly sorted	4.2	14.2
Sand, well sorted[a]	1.8	16.0

[a]Well terminated at this depth.
Source: ORNL, 1992.

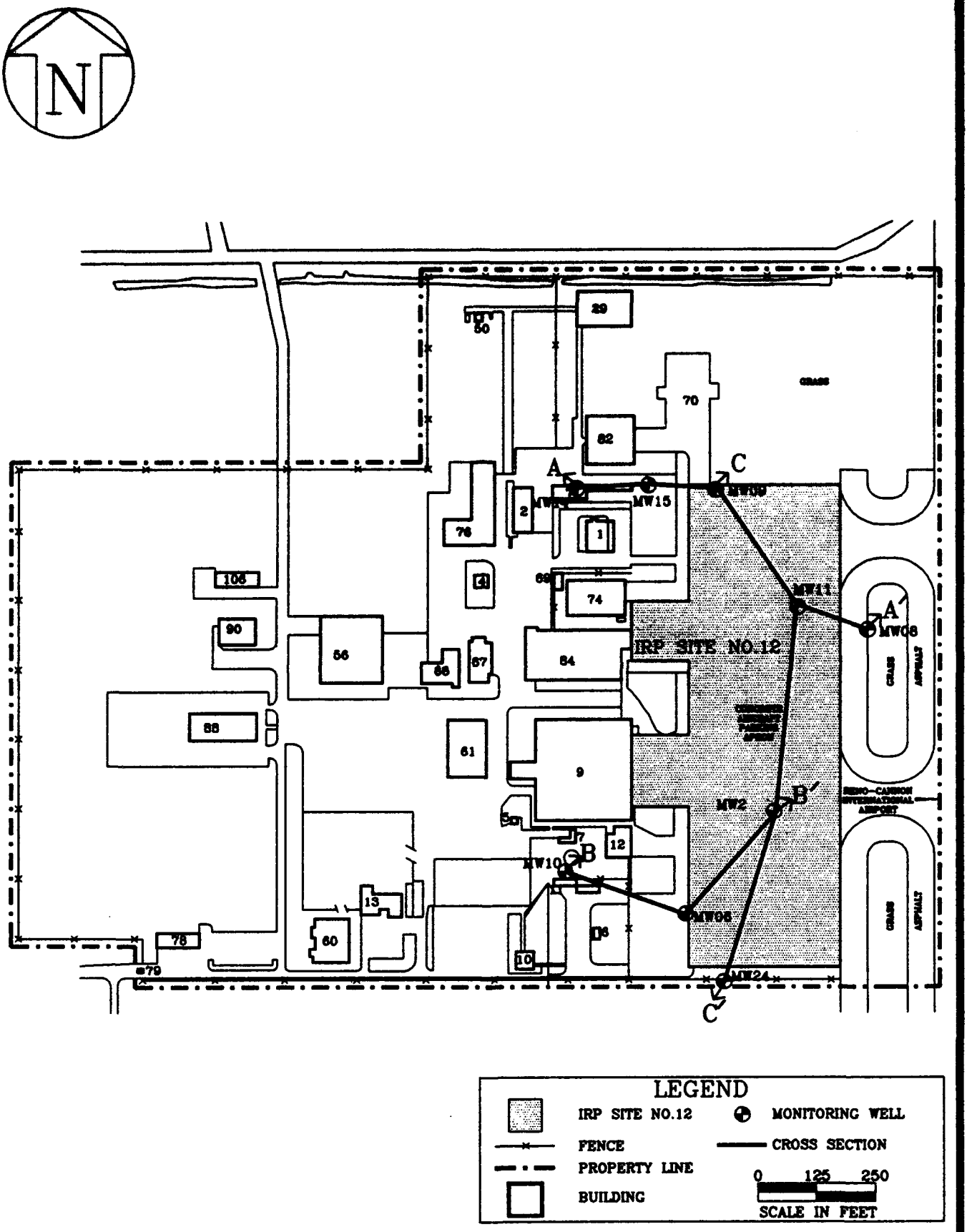

FIGURE 3.3

K\RENO\GEOL-X

GEOLOGIC CROSS SECTION LOCATION MAP

152nd RG, Nevada Air National Guard

Reno, Nevada

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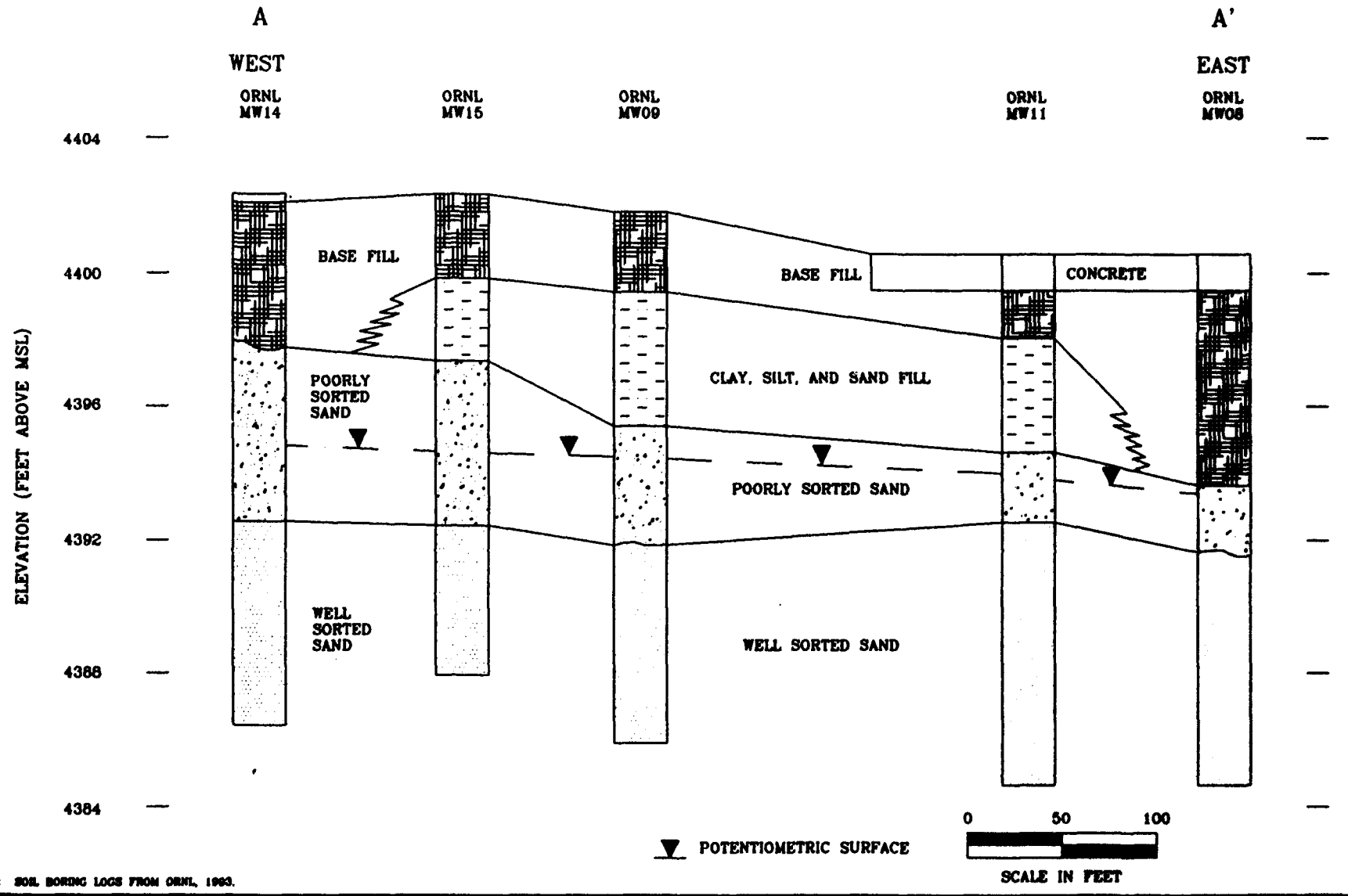

FIGURE 3.4

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GEOLOGIC CROSS SECTION A–A'

152nd RG, Nevada Air National Guard
Reno, Nevada

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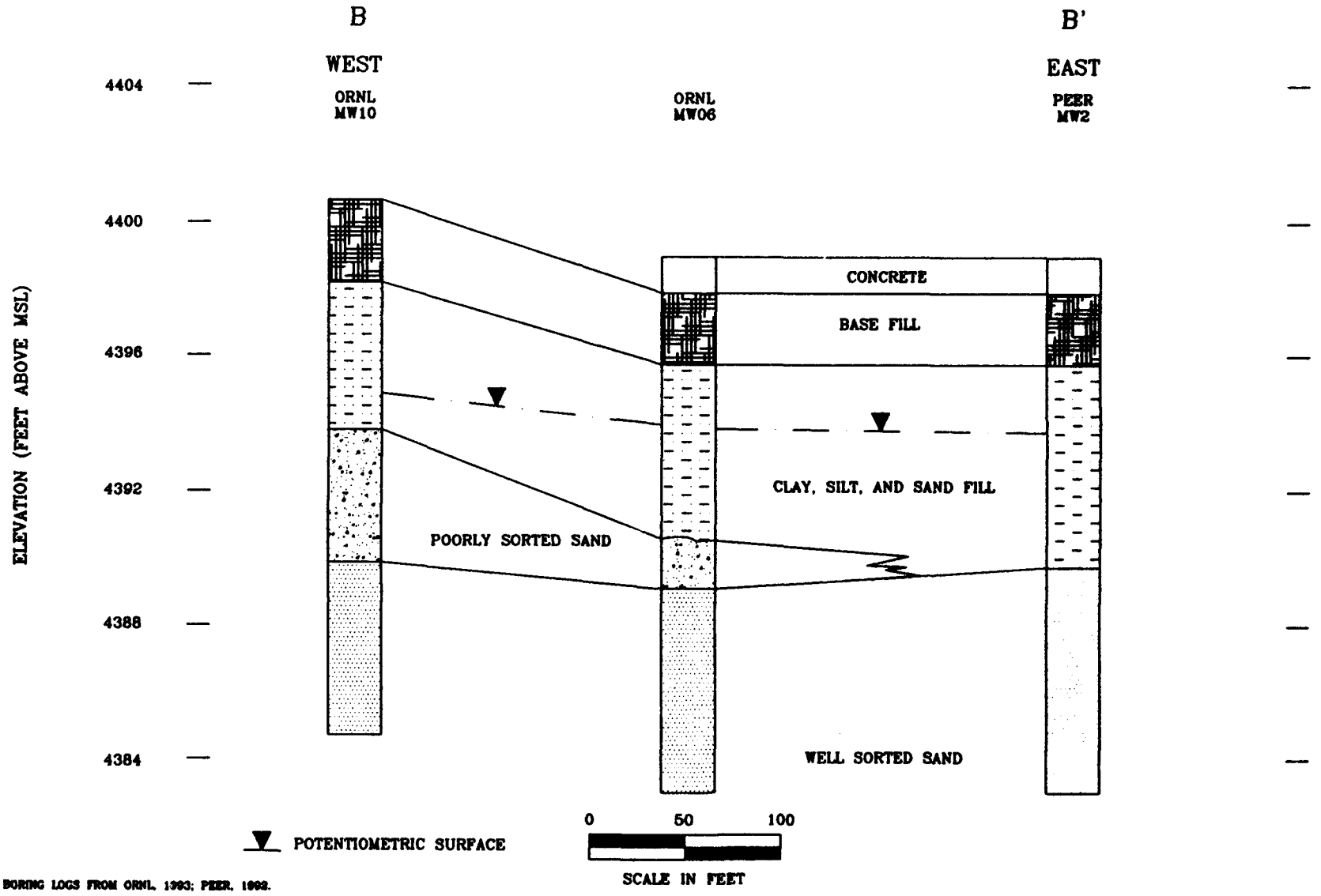

FIGURE 3.5

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GEOLOGIC CROSS SECTION B-B'

152nd RG, Nevada Air National Guard
Reno, Nevada

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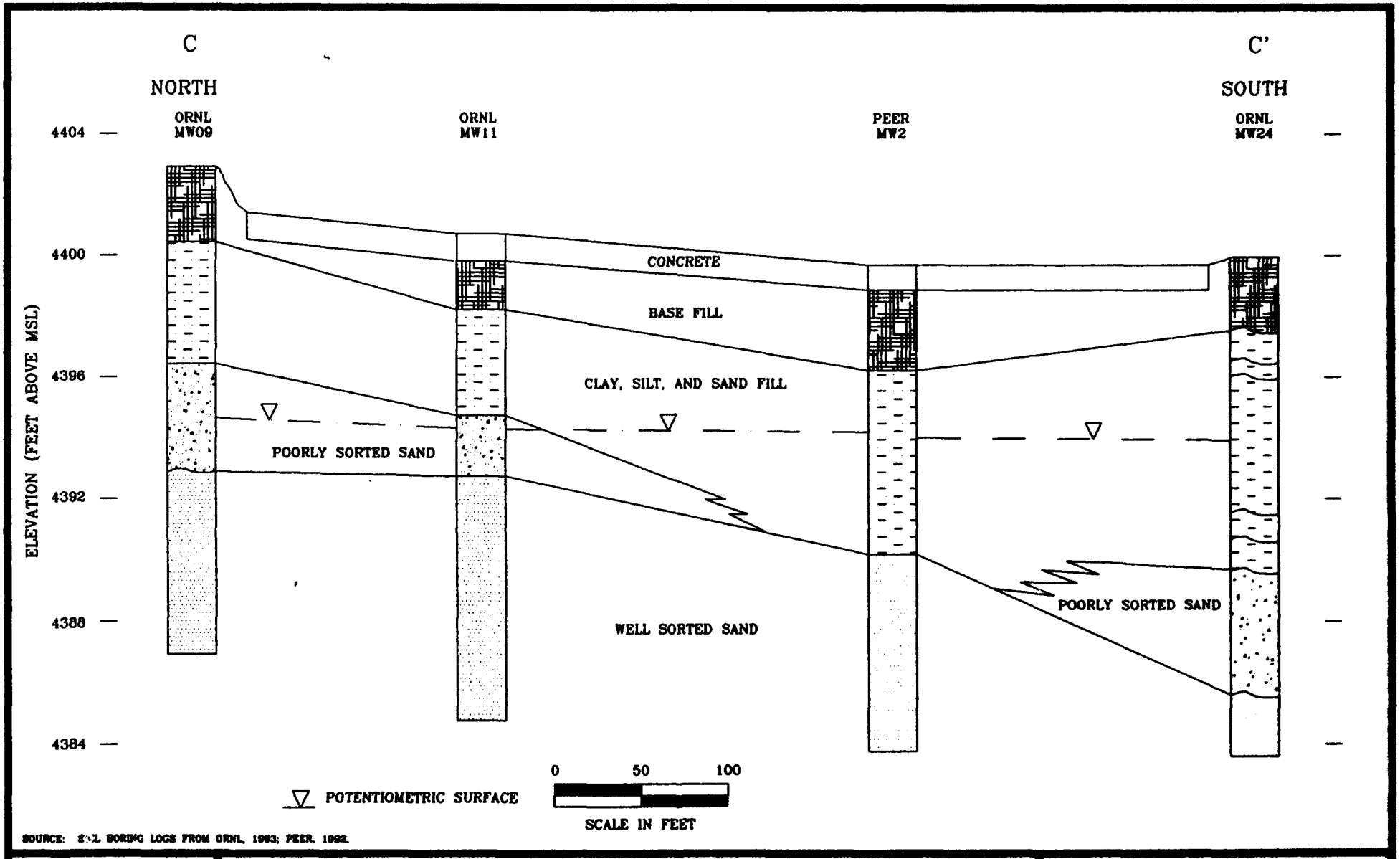

FIGURE 3.6

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GEOLOGIC CROSS SECTION C–C'

152nd RG, Nevada Air National Guard
Reno, Nevada

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3.4 SOILS

The Truckee sandy loam found underlying the Base is a deep, somewhat poorly drained, sandy loam stratified with silt clay and underlain by a gravelly substratum (Figure 3.7). Permeability of the Truckee soil is moderately slow in the upper part and rapid in the lower part. This is most likely a result of interbedded fine and coarse-grained materials in the upper soil horizons.

Runoff is very slow and the soil is subject to flooding during storms of prolonged high intensity (United States Department of Agriculture [USDA], 1983).

From a depth of 0 to 12 inches below land surface (BLS), permeability is 2.6 to 6.0 in./hr [1.4 x 10^{-3} to 4.2 x 10^{-4} centimeters per second (cm/sec)]. At a depth of 12 to 30 inches BLS, it ranges from 0.2 to 0.5 in./hr (1.4 x 10^{-4} to 4.2 x 10^{-4} cm/sec). From 30 to 60 inches BLS, the permeability of the soils is in the range of 6.0 to 20.0 in./hr (4.2 x 10^{-3} to 1.4 x 10^{-2} cm/sec) (USDA, 1983).

Immediately to the south of the Base is the Vamp silt loam soil. This is a silty loam shallow horizon underlain by a find sandy loam and a strongly cemented hardpan.

3.5 HYDROLOGY

3.5.1 Hydrogeology

Three aquifers underlie the Base. These aquifers, in descending stratigraphic sequence, are the younger alluvium, the older alluvium, and the Truckee Formation. Most of the economically recoverable groundwater in the Truckee Meadows area occurs under artesian and water table conditions in the unconsolidated and partially consolidated younger and older alluvium of the valley fill (Cohen and Loeltz, 1964).

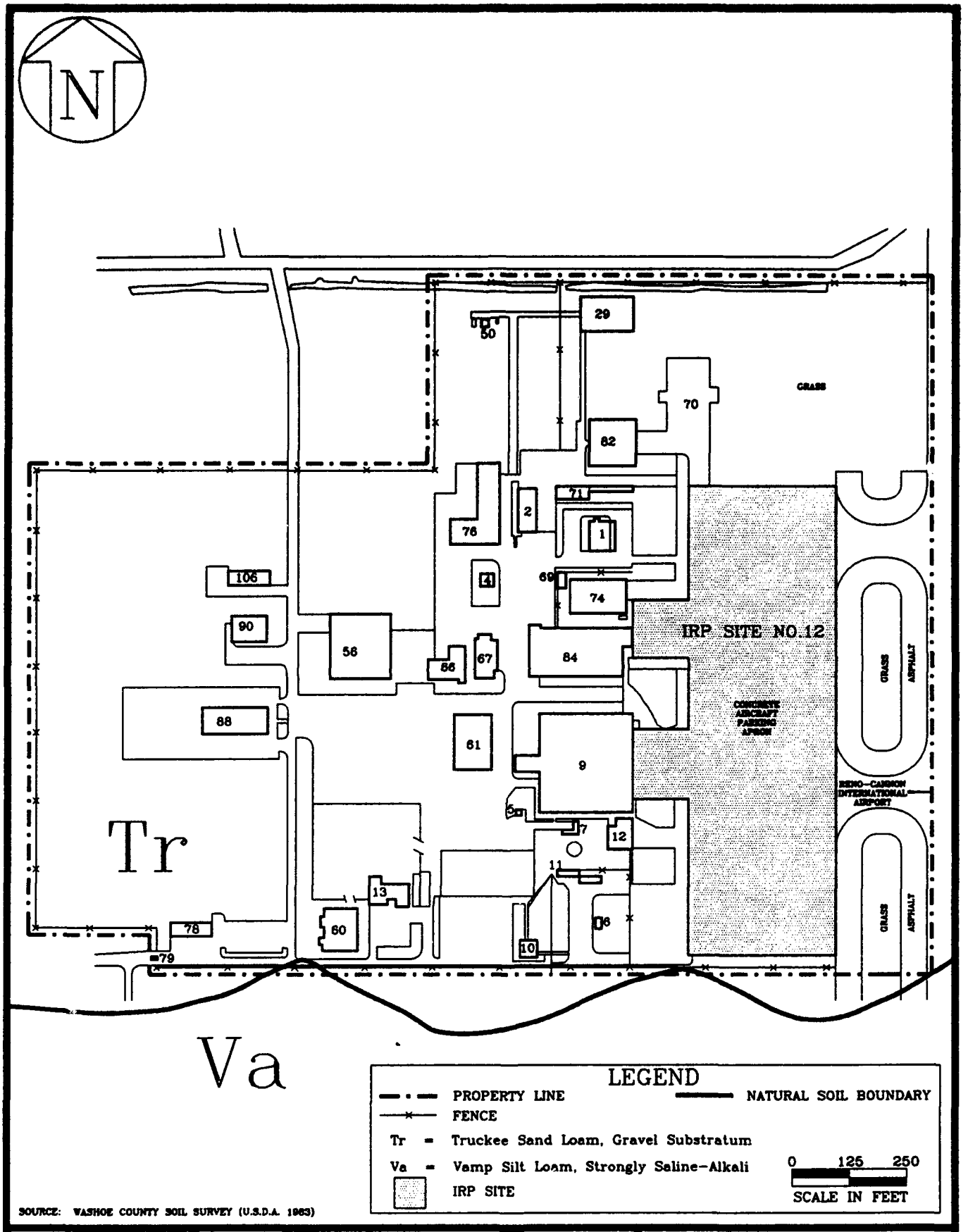

FIGURE 3.7

SOIL MAP
152nd RG, Nevada Air National Guard
Reno, Nevada

R:\RENO\SOILMAP

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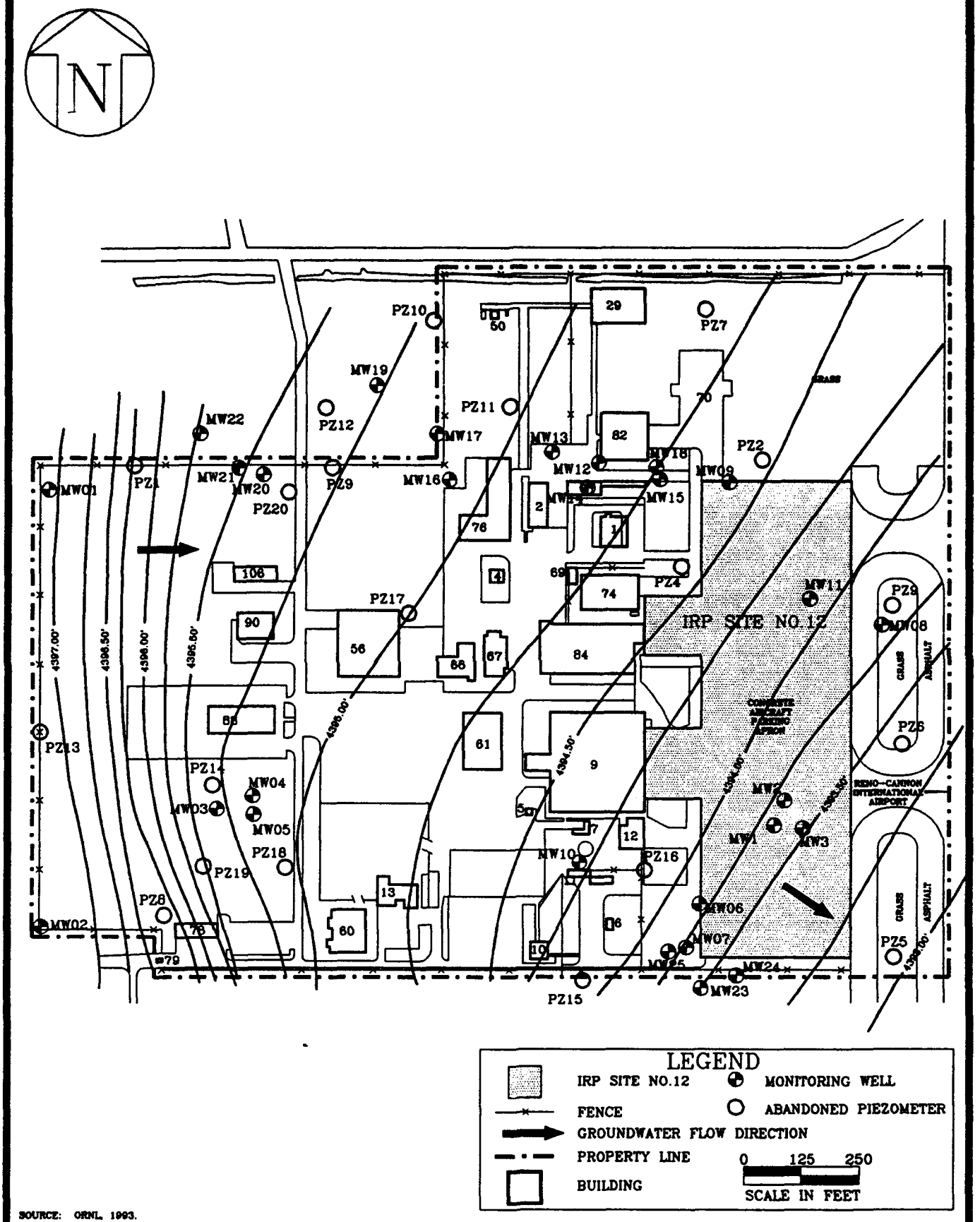
The Truckee Formation consists of porous deposits, and, owing to its great saturated thickness, it contains a large amount of groundwater in storage. However, due to its fine-grained nature, it is characterized by low permeability and low yields. Due to the rapidly changing depositional environments and structural deformation, the water-bearing characteristics of both the young and older alluvium are widely varying, both laterally and vertically, within a few feet.

Movement of regional groundwater flow is northeastward, toward a discharge point in the Truckee River east of the Reno-Cannon airport (Cohen and Loeltz, 1964). However, Figure 3.8 shows a localized, water table elevation map at the site. The map, developed by ORNL, indicates the direction of groundwater flow is toward the southeast. This indicates there may be a shallow or perched water-bearing strata immediately below the concrete apron.

There are two public water wells located within one mile of the Base (Figure 3.9). Table 3.3 shows the stratigraphy of WestPac Utilities' Terminal Way approximately 4,000 feet north of the site. The well is screened from 330 to 685 feet, indicating the water wells in the area are screened through a large interval at considerable depth.

Recharge to the groundwater system is from the infiltration of water diverted for irrigation, from the infiltration of streamflow and precipitation, and from underflow from tributary valleys.



SOURCE: ORNL 1993.

FIGURE 3.8

R\RENO\GROUND

GROUNDWATER ELEVATION MAP
AS OF DECEMBER 4, 1992
152nd RG, Nevada Air National Guard
Reno, Nevada

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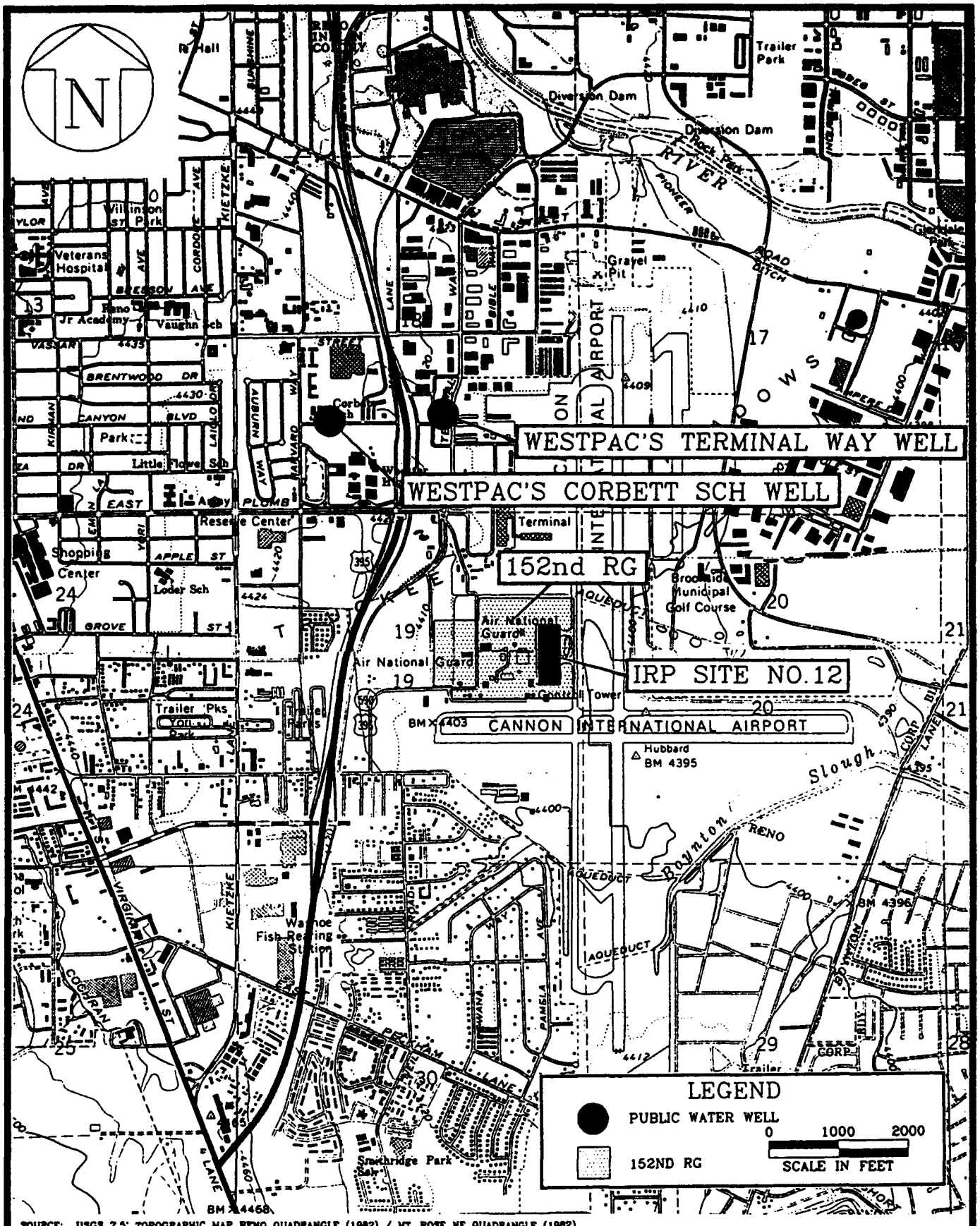

SOURCE: USGS 7.5' TOPOGRAPHIC MAP RENO QUADRANGLE (1982) / MT. ROSE NE QUADRANGLE (1982)

FIGURE 3.9

R:\RENO\PUBLIC

PUBLIC WATER WELL LOCATION MAP

152nd RG, Nevada Air National Guard
Reno, Nevada

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Table 3.3
WestPac Utilities' Terminal Way Well Log
Showing Typical Deep Stratigraphy in the Area[a]
152nd RG, Nevada Air National Guard, Reno, Nevada

Lithology	Thickness (ft)	Depth From Surface to Bottom of Layer (ft)
Top soil, sand, gravel, and boulders	136	136
Boulders, gravel, sand, and clay	194	330[b]
Interbedded sands, clays, and sandy clays	115	445[b]
Interbedded sands, gravels, and shales	240	685[b]

[a]Approximately 4000 feet north of the site.
[b]Screened interval.
Source: Squirre, 1993.

3.5.2 Surface Water

The Truckee River is the major drainage feature for the Truckee Meadows. The river heads in the Sierra Nevada south of Lake Tahoe, and flows northward and northeastward to the City of Verdi, Nevada. From there, the river flows eastward in a meandering course through Truckee Meadows, and drains into Pyramid Lake to the northeast of Reno (Cohen and Loeltz, 1964). It is located approximately 1.5 miles north of the airport. The Flood Insurance Rate Map (FIRM) of Washoe County indicates the airport does not lie within a 100-year floodplain (Harding Lawson Associates, 1992).

The Truckee River is the primary source of municipal water for the cities of Reno (which includes the Base) and Sparks. These cities receive 85% of their water from the Truckee River during normal times and 75% during periods of drought (Carson, 1993). Groundwater augments the remaining percentage.

The surface water hydrology immediately around the airport is characterized by both open and covered channel drainage ditches. Drainage ditches are located along all four sides of the airport. They transport surface water generally toward the east, across the airfield, and into Boynton Slough that feeds into Steamboat Creek and then into the Truckee River (Figure 3.10).

3.6 ENDANGERED FISH AND WILDLIFE

According to the Nevada National Heritage Program (NNHP) in Carson City, Nevada, there are no records of sensitive habitats or endangered species with one mile of the Base. The Truckee River does furnish a habitat for the threatened Lahontan Cutthroat Trout and the endangered Cui-ui. The Cui-ui is indigenous to Pyramid Lake.

There are no major wetlands within a one-mile radius of the Base. There is a 65-acre swampy area located 2 miles east-southeast of the Base near the confluence of Steamboat Creek and Boynton Slough. Since this area is upstream from Boynton Slough, the drainage from the Base that enters Steamboat Creek by way of Boynton Slough should not influence it.

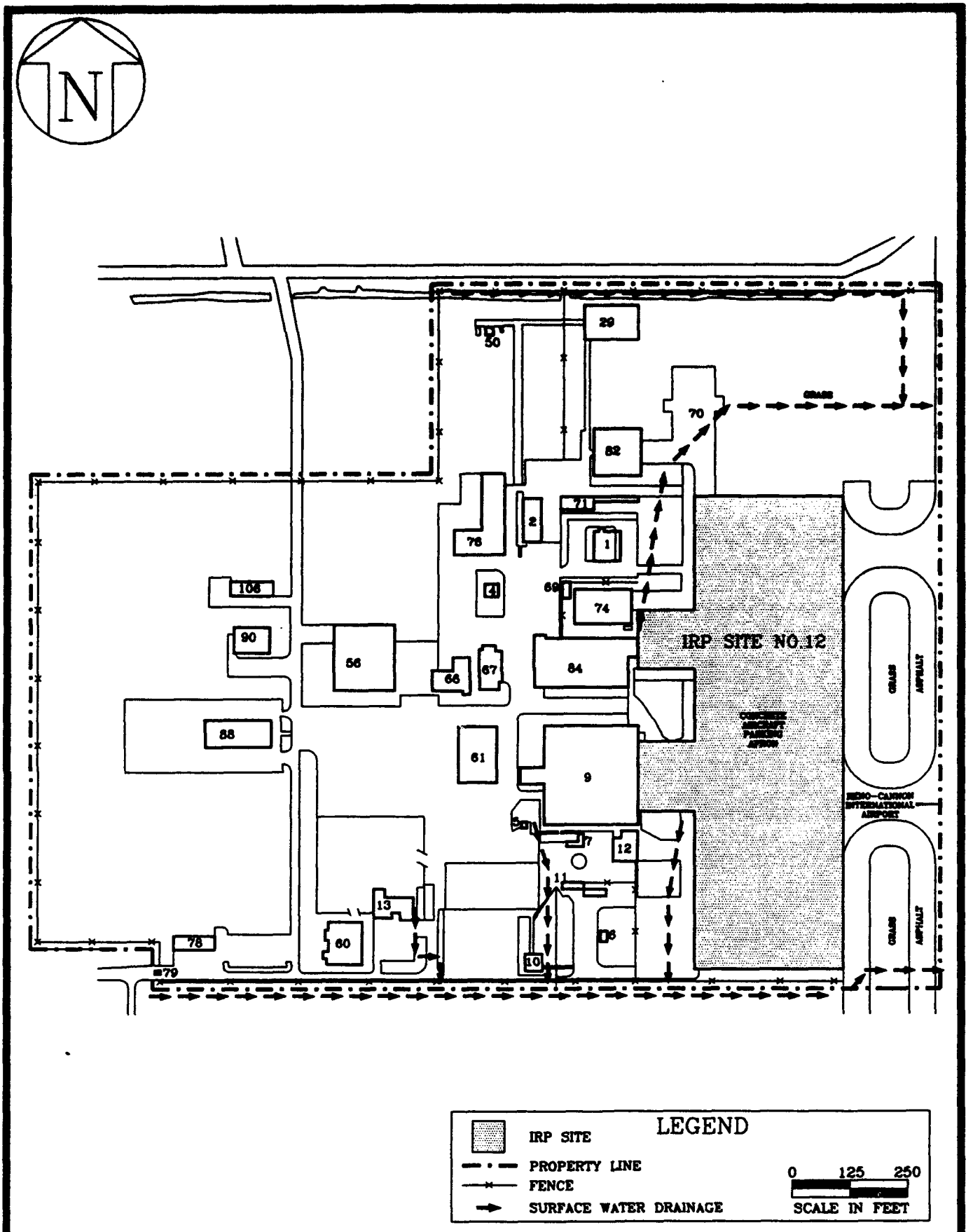

FIGURE 3.10

F:\RENO\SWDRAIN

SURFACE WATER DRAINAGE
152nd RG, Nevada Air National Guard
Reno, Nevada

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MARCH 1994

SECTION 4.0 FIELD PROGRAM

The purpose of this SI was to confirm, through field activities, the presence or absence of contamination under the Aircraft Parking Apron Area, to attempt to determine the areal extent of any contaminants detected, and to provide data needed to reach a decision point for the site.

The specific objectives of the SI are to:

- Provide data to assist in determining the presence or absence of contamination and the type.
- Obtain information to attempt to delineate the horizontal and vertical extent and magnitude of contamination on-site.
- Define hydrogeologic conditions that could affect contaminant migration, containment, or cleanup.
- Support site-specific decisions, such as no further IRP action is warranted, prompt removal of contaminants is necessitated, or further IRP work is required.
- Gather information to support the corrective action plan.
- Establish a plan for determining if remediation is needed during future slab removal projects and how remediation would be accomplished.

This section describes the field activities performed during the site investigation to accomplish the above objectives, and the methodologies used to conduct these activities. The field investigation at the 152nd RG commenced on 25 October 1993 and was completed on 6 November 1993. Field activities were resumed from 3 January 1994 to 6 January 1994 to resample for VOCs in the soil. The VOC analysis results for soil samples collected in

October-November of 1993 were determined to be invalid due to exceeding the 14-day hold time.

4.1 GENERAL INVESTIGATION APPROACH

The field investigation at the 152nd RG incorporated a soil vapor survey and the use of soil borings and groundwater monitoring wells in order to:

- Screen soil for contamination at the suspected site;
- Determine site-wide groundwater flow direction;
- Sample groundwater for contamination downgradient of the site;
- Collect soil data from the suspected site; and
- Collect groundwater data downgradient of the suspected site.

A site-specific soil vapor survey was conducted prior to the commencement of soil boring or groundwater monitoring well drilling activities. The soil vapor survey was used at the site as a screening tool for determining the optimum number and location of soil borings needed to confirm the absence or presence of soil contamination. Water levels in monitoring wells in and around the site were measured and recorded to establish local groundwater flow direction.

Six soil borings were installed to determine whether contamination exists at the site, and if it does exist, to attempt to determine the nature and extent of the contamination. Two groundwater monitoring wells were installed to identify the presence and extent of groundwater contamination downgradient of the site.

4.2 DETERMINING BACKGROUND LEVELS

Determining background data was not within the SI scope of work. ORNL conducted background sampling during the September 1992 - March 1993 SI.

4.3 DEVIATIONS FROM THE WORK PLAN

There were some deviations from the work plan. However, in no way did any of the changed procedures or protocols prevent accomplishment of the overall objectives of this site investigation.

The deviations from the work plan and the rationale for the changes are described as follows:

- The six soil borings at the site were redrilled and resampled for VOCs. The laboratory allowed the USEPA Method SW8260 14-day hold time to elapse before analysis. Soil samples were collected from a soil boring drilled approximately 2 feet from the original boring and at the same depth. The samples were collected with a carbon steel California-style split spoon sampler instead of stainless steel.

- During the January 1994 soil sampling for VOCs, borings were labelled on the chain-of-custody with the letter B as opposed to BH. Nomenclature was corrected for the report.

- The ANGRC did not authorize the drilling of monitoring well MW28. Collection of water samples for chemical analyses from monitoring well MW09 was not authorized by ANGRC.

- A soil sample from the 7.0 - 8.5 foot interval BLS at soil boring BH37 was not recovered during sampling in October-November 1993. The sample was collected from the 6.5- - 8.0-foot interval BLS from the twin soil boring BH37A during the second drilling activity in January 1994 and was analyzed for VOCs, SVOCs, TPH, and lead.

- Water levels were not recorded from monitoring wells MW14 and MW25 nor from any of the piezometers. Field personnel were unable to open the lock from

MW14 due to rust. Contaminated water was found standing in the protective vault of MW25 and a field decision was made not to open the well cap in order to prevent possible well contamination. All piezometers at IRP Site No. 12 had been removed; therefore it was not possible to measure and record water levels as described in the work plan.

- USEPA Method SW8260 was used by the laboratory instead of Method SW8240. Method SW8260 uses a capillary extraction method, whereas Method SW8240 uses a packed column.

4.4 FIELD SCREENING ACTIVITIES

4.4.1 Soil Vapor Surveys

Prior to installation of soil borings and monitoring wells, a soil vapor survey was conducted at the site. Soil vapor surveying was used to identify the presence and to attempt to delineate the extent of total FID and BTEX contamination. Total FID contamination is the summing of all flame ionizable compounds detected from C_2 to C_{11}. The results were used as a screening tool for developing the optimum number and location of soil borings needed to characterize and to attempt to delineate soil contamination. The results also served as a guide in the final selection of monitoring well locations. The highest density of sample points was under the five aircraft rows.

The soil vapor survey was conducted by Target Environmental Services (TES). A set of 64 sampling points formed a base grid over the entire aircraft parking apron with a distance of no more than 90 feet between sampling points. An additional 11 sampling points were sampled to investigate areas of additional interest, resulting in a total of 75 sample points.

A probe, consisting of 1-inch pipe fitted with teflon tubing and a notched drive point, was driven into the ground to a depth of 2 feet BLS (which includes the 1 foot of parking apron) with a hydraulic hammer. Holes for sampling points were first drilled through the concrete before the

probe was hammered in. After the probe was driven in, the casing was hydraulically raised several inches in order to release the disposable drive point and open the bottom of the casing. A teflon line with a perforated hollow stainless steel probe end was inserted into the casing to the bottom of the hole, and the bottom-hole line perforations were isolated from the up-hole annulus by an inflatable packer. A sample of *in situ* soil vapor was then withdrawn through the probe and used to purge atmospheric air from the sample system. A second sample of soil vapor was withdrawn through the probe and contained in a pre-evacuated glass vial at two atmospheres of pressure (15 pounds per square inch gauge (psig)). The first sample was collected at 2 feet BLS, and then the probe was driven deeper for the collection of a second sample at 5 feet BLS. Soil vapor samples were analyzed immediately using an on-site mobile laboratory. Samples were analyzed for BTEX using Modified USEPA Method 602. Total FID volatiles were obtained by summing the areas of all integrated chromatogram peaks and calculating the total concentration using the instrument response factor for toluene. A field duplicate was collected for every ten samples to provide a quality assurance check on analytical procedures and results. Soil vapor survey results are fully discussed in Section 5.2.2.1 and included in Appendix A.

4.4.2 Soil and Groundwater Screening

During soil sampling of soil borings and groundwater monitoring wells, the air around the sampler was monitored with a MicroTip PID immediately upon opening the sampler (to maximize the detection of volatiles). The soil samples collected were placed in plastic bags, and the MicroTip PID used to screen the headspace for photoionization compounds. Soil was also field screened using a Photovac 10S55 Portable Gas Chromatograph (GC). All PID readings are indicated on the boring logs included in Appendix D. The Photovac 10S55 Portable GC, calibrated to screen for BTEX, was used to detect the presence of these compounds in the headspace from the soil samples collected. Headspace analysis was used as a tool to determine which sample intervals best characterized the environment of the borehole or demonstrated the highest headspace reading. Data obtained from the field GC and PID were used to determine which soil samples were sent to the laboratory for analysis.

Likewise, the GC was used to analyze headspace from water samples. Field screening of water samples was conducted to provide the Project Manager with preliminary water quality information and to supplement laboratory analytical data.

Field GC data, summarized in Section 5.2.2.2, Field GC Screening Results, are included in Appendix C.

4.5 CONFIRMATION ACTIVITIES

Western State Exploration, West Sacramento, California was retained as the drilling contractor for drilling boreholes and for installation of monitoring wells for the field activities during October-November 1993. Layne-Western Company, Woodland, California, was retained as the drilling contractor for drilling the twin boreholes for the January 1994 field activities. The selected drilling contractors mobilized personnel and equipment that met or exceeded NV ANG, NDCNR, or other relevant regulatory requirements.

Chemron Incorporated, San Antonio, Texas, was retained to perform chemical analyses. Provisions were made for proper sample containers, labels, chain-of-custody forms, sample stabilization and preservation, insulated sample shipping containers, and packing materials. Nevada Environmental Laboratory, Reno, Nevada, was retained to perform chemical analyses for VOCs on field duplicates during the January 1994 sampling.

Gump Surveying, Inc., of Sparks, Nevada, was retained as the surveying contractor. The site boundaries, buildings, aircraft parking apron, all monitoring wells, and soil boring locations were surveyed. The land surface elevations of each borehole are shown on the borehole logs and well construction diagrams included in Appendices D and B, respectively.

4.5.1 Soil Borings

Soil borings were installed to obtain soil samples for laboratory analysis for defining any existing soil contamination, and to aid in defining the vertical and horizontal extent of contaminants at

the site. Soil samples were also used for determining site geology and subsurface soil characteristics.

Soil borings were drilled by using hollow-stem auger (HSA) methods. Auger flights, the drill rig, and tools were thoroughly steam-cleaned in the designated decontamination area at the south end of the aircraft parking apron before initial use and after the completion of each borehole.

The monitoring wells were installed using HSA methods. The HSA drilling method employs a hollow helical steel drill tool that is rotated to advance the boring and lift formation materials (cuttings) to the surface. The flights for the HSA are welded onto steel pipe and a cutter head is attached to the "lead" (bottom) auger to cut the hole. During drilling, a center bit is inserted into the hollow area of the cutter head that prevents cuttings from re-entering the hollow portion of the auger. Generally, the center bit is flush with or extends no more than 1/2 foot below the cutter head. The center bit connects through the auger flights by small diameter drill rods and is attached to the top-head drive unit of the drill rig. The top-head drive is powered by a truck-mounted engine that mechanically rotates the entire flight of augers. The hollow opening allows the insertion of sampling tools (i.e., California-style or continuous sampler) with the augers in place to prevent caving of the borehole.

Six soil borings (BH35 through BH40) were drilled for data collection in October - November 1993. VOC samples collected from these borings exceeded the 14-day hold time. As a result, six twin soil borings (BH35A through BH40A) were drilled in January 1994 and sampled for VOCs. The six twin soil borings were drilled within three feet of the original soil boring. All work was performed in a manner consistent with NDCNR regulations. Ten-inch-diameter holes were cored in the concrete of the parking apron for the soil borings. In accordance with a request by the Base Civil Engineering office, borings were not placed within 2 feet of the edge of the concrete slabs.

Depth of the soil test borings was limited to the depth where saturated material was encountered. Soil samples were collected at 5-foot intervals for subsurface characterization and field screening. An 18-inch carbon steel California-style sampler equipped with three 6-inch brass

sleeves was used for collecting soil samples for laboratory analysis from various 18-inch intervals between depths of 0.5 to 4.5 feet BLS and from immediately above the water table. Actual sample depths submitted for laboratory analysis are discussed in Section 5.2.3, Soil Investigation Findings, and shown on the borehole logs included in Appendix D. The California-style sampler was decontaminated and new brass sleeves inserted before each sampling event. Also, during drilling of both monitoring wells, soils were sampled every 5 feet to the water table for determining site geology and subsurface soil characteristics.

Borehole abandonment activities conformed to applicable Nevada requirements. Borings were backfilled with bentonite-cement grout immediately after the sampling had been accomplished to prevent the downward migration of contaminants through the open borehole. Borings were bentonite grouted from the bottom of the borehole to the surface using a tremie pipe. Bentonite-cement grout was used as to not cause structural support problems with the parking apron. For those borings on the aircraft parking apron (BH35, BH36, BH40 and their respective twin borings), the top foot of the borehole was completed with Concresive 2020 polymer concrete system.

4.5.2 Monitoring Well Installation

A base-wide piezometer and monitoring well network was installed by ORNL, prior to OpTech's activities. ORNL used groundwater level measurements from the well network to prepare potentiometric surface maps. From this groundwater flow direction data, it was decided to install downgradient monitoring wells MW26 and MW27 along the southeast edge of the aircraft parking apron.

Monitoring wells were installed to obtain water level data for hydrogeologic characterization of the aquifer, evaluate horizontal groundwater flow characteristics, and obtain groundwater samples for laboratory analysis.

Auger flights, drill rig(s), and tools were thoroughly steam-cleaned in the designated decontamination area south of the aircraft parking apron before initial use and after the

completion of each monitoring well. Likewise, all casing and screens installed in monitoring wells were thoroughly steam-cleaned before placement within the wellbore.

The monitoring wells were installed with a truck-mounted drill rig using HSAs having an ID of 3.25 inches, to a depth of 15 feet BLS. The monitoring wells were constructed of 2-inch-diameter Schedule 40 polyvinyl chloride (PVC) casing and screen. A 10-foot section of 0.010 slotted screen was installed in each monitoring well. The tops of the screens were approximately equal to the static water level, and a filter pack was placed around each screen to a point at least 2 feet above the top of the screen. The filter pack was composed of washed, 10-20 grade silica sand. A 2-foot bentonite pellet seal was placed above each filter pack and allowed to hydrate a minimum of one hour. Above the bentonite seal, bentonite-cement grout was backfilled around the casings. All of the monitoring wells were completed flush with the ground surface. A concrete collar was installed at the surface around a protective steel vault. Monitoring well construction diagrams are included in Appendix B.

The static water level was allowed to equilibrate for a minimum of 24 hours before water levels were measured using an ORS Model 1068 Oil-Water Interface Meter. The monitoring well coordinates, top-of-casing elevations, and ground elevation were determined by a professional surveyor.

A rising head slug test was conducted at monitoring well MW26 to determine aquifer properties. The slug was constructed of 5.25 feet of 0.75-inch-diameter PVC pipe, filled with sand and capped on both ends. After decontamination, the slug was lowered below the water surface. The water level in the wellbore was monitored using an ORS Model 1068 Oil-Water Interface Meter until it returned to the initial static level. The slug was removed after the pre-displacement water level had been reached, and the rise in water level back to its initial static level was measured at closely spaced time intervals using a Hermit Model SE1000C Environmental Data Logger. The resulting data was used to compute hydraulic conductivity, and is included in Appendix E.

4.5.3 Specific Media Sampling

This subsection summarizes the analytical program followed for soil and groundwater samples collected during the site investigation to determine the nature, magnitude, and extent of contamination at the site. Also included in this subsection is a brief discussion of quality control procedures followed during the field sampling activities.

4.5.3.1 Soil

Past activities at the site indicate that suspected contamination consists primarily of aviation fuel and associated wastes. Therefore, the primary analytical program of the SI focused on the detection of VOCs, SVOCs, TPH and lead.

To comply with NDCNR requirements, soil samples from the soil borings were analyzed for VOCs using Method SW8260, for SVOCs using Method SW8270, for TPH using California modified 8015, and for lead using Method SW7421. As previously discussed in Section 4.3, Deviations From The Work Plan, VOCs were analyzed by Method SW8260 instead of Method SW8240.

Table 4.1 summarizes the analytical programs conducted for the soil samples to conform to the NDCNR requirements.

4.5.3.2 Groundwater

Following the analytical procedures outlined in Section 4.5.3.1, two rounds of groundwater sampling occurred during the SI. The groundwater samples were analyzed for VOCs using Method SW8020, for SVOCs using Method SW8270, for TPH using California modified 8015, and for lead using Method 239.2.

Table 4.1 summarizes the analytical program for the groundwater sampling designed to detect suspected contaminants at the site.

Table 4.1
Laboratory Analyses Summary Table
152nd RG, Nevada Air National Guard, Reno, Nevada

Matrix	Field Parameters	Lab Parameters	USEPA Method	Investigating Samples	Number of Field QA/QC Samples					Matrix Totals
					Trip Blanks	Equipment Blanks	Field Blanks	Field Duplicate	MS/ MSD	
Soil (Subsurface)	Soil Screening using GC PID Soil Classification	VOCs	SW8260*	12	4**	2**		2	2	16
		SVOCs	SW8270	12		2**		2	2	16
		TPH	8015***	12		2**		2	2	16
		Lead	7421	12		2**		2	2	16
Groundwater	Temperature, pH, Specific Conductance	VOCs	SW8020	10	2**	2**	2	2		14
		SVOCs	SW8270	10		2**	2	2		14
		TPH	8015***	10		2**	2	2		14
		Lead	239.2	10		2**	2	2		14

VOCs – Volatile Organic Compounds.
SVOCs – Semivolatile Organic Compounds.
TPH – Total Petroleum Hydrocarbons.
* – Work Plan called for Method SW8240 however, Method 8260 was used to obtain a lower detection limit.
** – Trip and Equipment Blanks are not counted in Matrix totals.
*** – California modified 8015.

4.5.3.3 Quality Control of Field Sampling

Field duplicate samples, field blanks, and trip blanks were submitted to the analytical laboratory for assessment of the quality of data resulting from the field sampling program. Field and trip blank samples were analyzed to check for procedural contamination and ambient conditions at the site that may have caused sample contamination. Duplicate samples were submitted to provide a quality assurance check on analytical procedures and results.

The level of the quality control effort included one field duplicate for every 10 or fewer investigative soil samples, and one field duplicate and one field blank for every 10 or fewer investigative water samples. One VOC analysis trip blank, consisting of distilled, deionized, ultra pure water, was included along with each shipment of samples. One matrix spike/matrix spike duplicate was collected for every 20 or fewer investigative soil samples. Matrix samples provide information about the effect of the sample matrix on the analytical methodology. The quality control level of effort for the field measurement of pH consisted of a pre-measurement calibration and a post-measurement verification using two standard reference solutions each time. This procedure was performed at least once per day or more often as necessary. Quality control effort for field conductivity measurements included a daily calibration of the instrument using standard solutions of known conductivity.

4.5.3.3.1 Soil Sample Preservation

Soil samples submitted for laboratory analysis collected with a California-style sampler were contained in brass sleeves. Immediately upon removal from the California-style sampler, the sleeve ends were covered with a teflon barrier and aluminum foil and fitted with a plastic cap. The plastic caps were then secured with duct tape. Prepared samples were placed in a sealed zip-lock plastic bag and immediately placed in the ice chest.

4.5.3.3.2 Groundwater Sample Preservation

VOC samples were preserved with no more than two drops of a 1:1 solution of hydrochloric acid per 40-milliliter (mL) glass Volatile Organic Analysis (VOA) vial having a teflon-lined lid. SVOCs samples were stored in 1-liter amber glass bottles having teflon-lined lids, and no preservatives. TPH samples were stored in 1-liter amber glass bottles having teflon-lined lids, and preserved with a solution of 1:1 sulfuric acid to achieve a pH less than 2. Lead samples were stored in plastic 250-mL bottles preserved with nitric acid.

4.6 INVESTIGATION DERIVED WASTE

During the SI, a certain amount of waste material (personal protective equipment (PPE), drill cuttings and purge water) were produced as a result of investigative activities. Drill cuttings were produced during the installation of soil borings and monitoring wells. Drill cuttings were preliminarily characterized by monitoring for organic vapor emissions with a MicroTip PID and screening with a Photovac 10S55 Portable GC. Nonetheless, all soil cuttings from each drilling location were drummed separately in steel, plastic-lined 55-gallon drums at the time of drilling. Additionally, all well development and purge water from each well location was drummed separately.

Miscellaneous derived wastes (e.g., gloves, visqueen sheeting, and wipes) which came in contact with drill cuttings having PID readings less than 100 ppm, when field-screened as described in Section 4.4.2, were disposed of in a general refuse container. Miscellaneous derived wastes generated during the drilling of borings and/or wells which had PID readings in excess of 100 ppm were drummed in steel 55-gallon drums.

All drums were properly marked to indicate their contents, the collection date, contractor's name and phone number, and borehole/monitoring well ID number. The final disposition of drummed materials is discussed in Section 5.3 of this report.

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5.0 INVESTIGATIVE FINDINGS

5.1 BACKGROUND FINDINGS

Collection of background data was not in the SI scope of work. ORNL conducted background sampling during the September 1992 - March 1993 SI.

5.2 SITE FINDINGS

5.2.1 Physical Characteristics

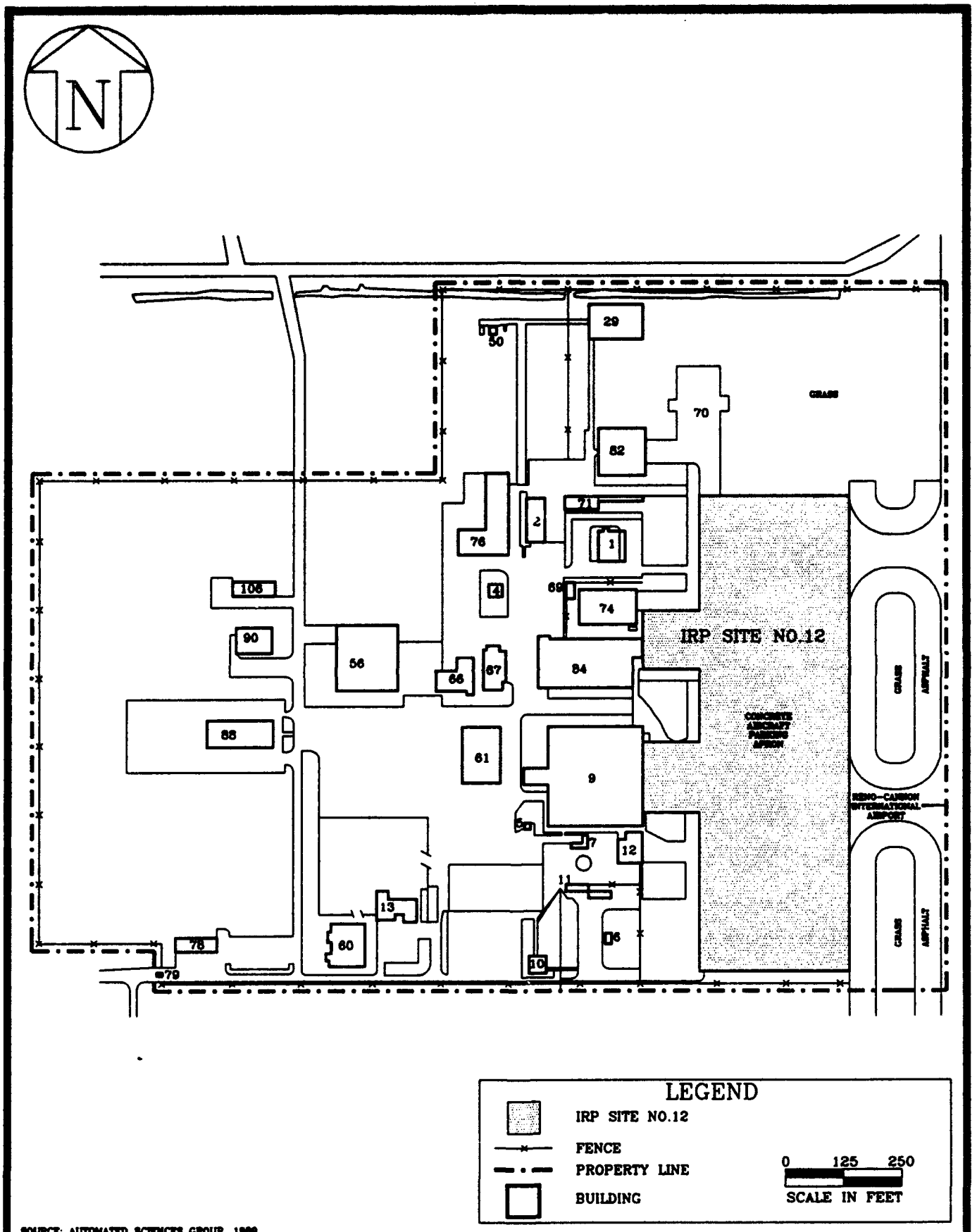
The Aircraft Parking Apron Site is located at the southeast corner of the Base, west of the N-S taxiway and north of taxiway "L" (see Figure 5.1). The site is rectangular in shape, 360 feet wide in the east-west direction and 1,020 feet wide in the north-south direction, flat, and encompasses approximately nine acres. The southern two-thirds of the site is composed of 12-by 15-foot concrete slabs, while the newer, northern one-third is composed of 25-by-25-foot concrete slabs. There are five areas, approximately 100 feet by 325 feet, where the aircraft are parked, serviced and refueled (Figure 5.2).

There are seven aboveground structures (Buildings 71, 1, 74, 84, 9, 12, and 6) located directly west of the site (Figure 5.1). Building 9 is the aircraft hangar, Building 84 is the squadron operations facility, and Building 6 is the POL area. Additional buildings, including the airport operations tower, are located south of the site, off-base.

5.2.2 Screening Activities Results

5.2.2.1 Soil Vapor Survey Results

A soil vapor survey was conducted by TES on 25 to 29 October 1993. The soil vapor survey encompassed the entire apron, although survey points were concentrated primarily under the five rows of parked aircraft. A total of 64 sampling points formed a base grid with a distance of no



SOURCE: AUTOMATED SCIENCES GROUP, 1988.

FIGURE 5.1

BASE MAP
152nd RG, Nevada Air National Guard
Reno, Nevada

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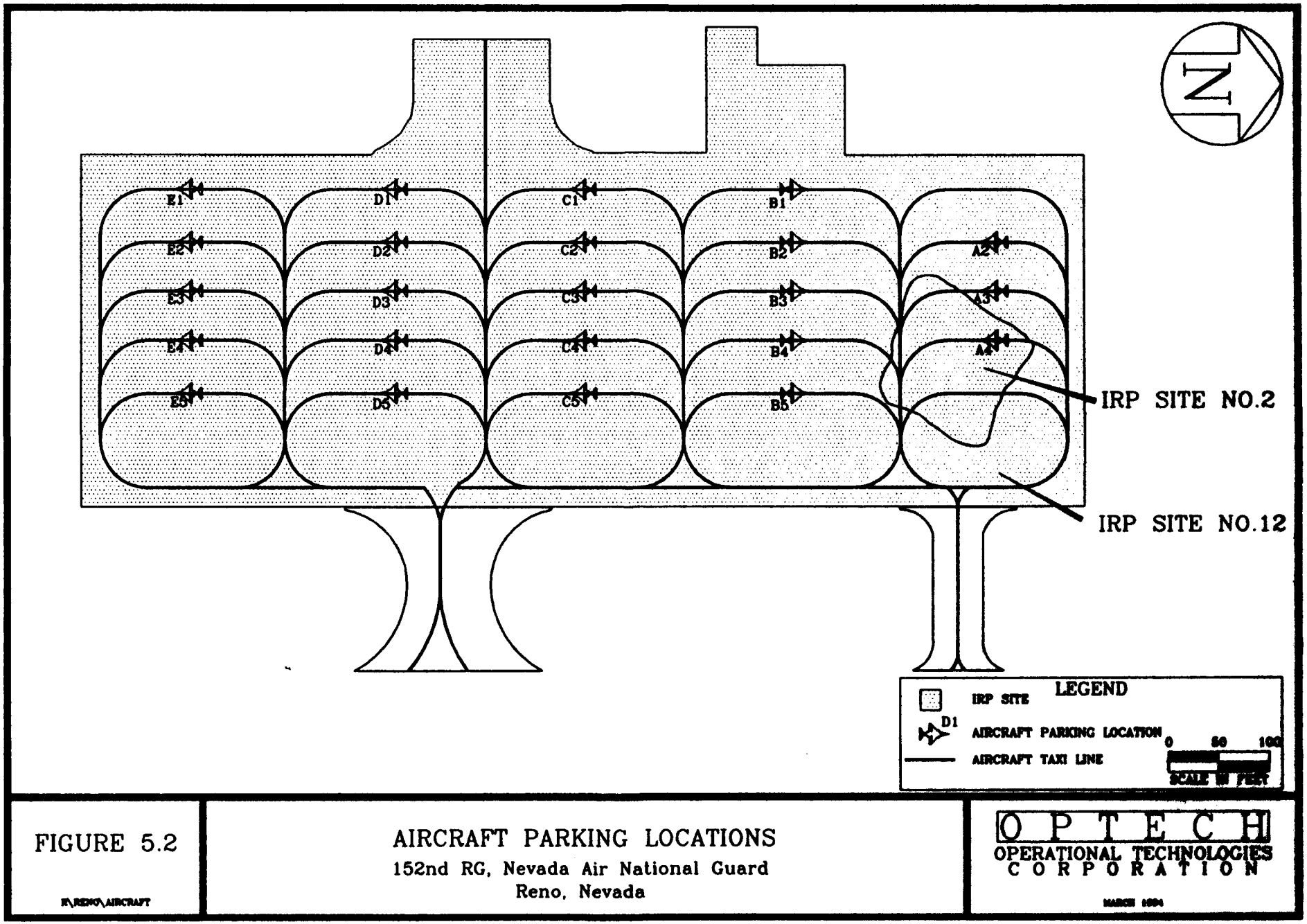

FIGURE 5.2

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AIRCRAFT PARKING LOCATIONS
152nd RG, Nevada Air National Guard
Reno, Nevada

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more than 90 feet between sampling points. The location of sampling points is illustrated on Figure 5.3.

Optional sampling locations were added as the soil vapor survey progressed. Proposed sampling point location numbers 65, 66, 67, and 72 were located to delineate an area of high readings. Sampling point location numbers 68, 69, 70, and 71 were located to sample the southern, downgradient boundary of the site. Sampling point locations 73, 74, and 75 were located to sample the upgradient northwestern and northern boundaries of the site.

Samples were obtained from depths of 2 feet BLS and 5 feet BLS. One hundred and fifty investigative samples were collected. Samples were analyzed for BTEX using USEPA Method 602 and total FID volatiles. Results for the latter parameter were obtained by summing the areas of all integrated chromatogram peaks and calculating the total concentration using the instrument response factor for toluene. Volatiles detected in total FID volatiles are all flame ionizable compounds from C_2 to C_{11}. Table 5.1 summarizes the maximum concentration detected and the detection limit for each analytical parameter. A complete listing of the soil vapor survey results is given in Appendix A. Results obtained from the soil vapor survey resulted in the selection of locations for the six soil borings.

Table 5.1
Maximum Concentrations Detected in Soil Vapor Survey
152nd RG, Nevada Air National Guard, Reno, Nevada

Analytical Parameter	Maximum Concentration Detected (µg/L)	Detection Limit (µg/L)
Benzene (µg/L)	481	1.0
Toluene (µg/L)	2,428	1.0
Ethylbenzene (µg/L)	1,692	1.0
Total Xylenes (µg/L)	897	1.0
BTEX (µg/L)	2,750	1.0
Total FID Volatiles (µg/L)	103,370	10.0

µg/L – micrograms per Liter.

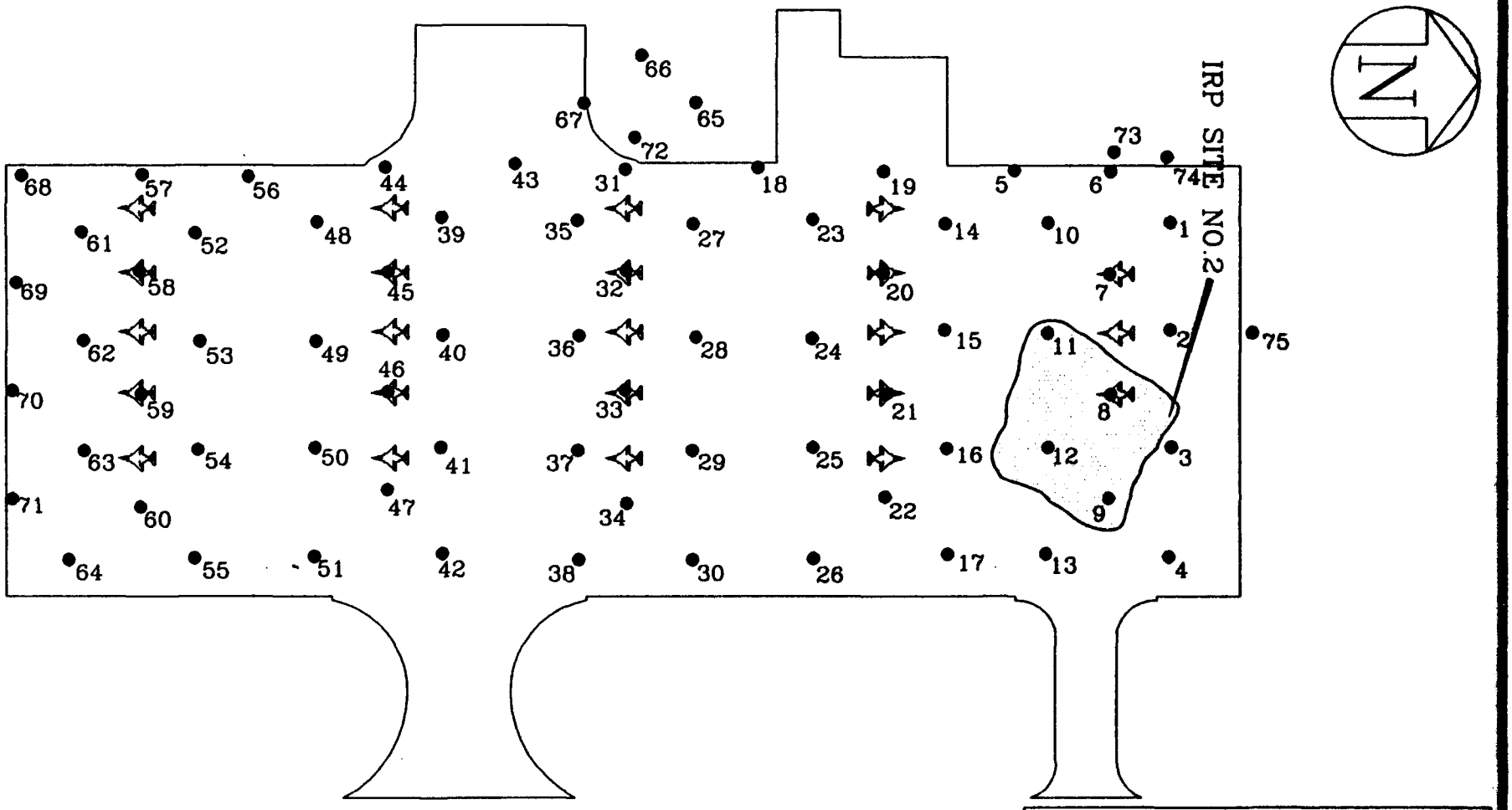

FIGURE 5.3

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SOIL VAPOR SAMPLING LOCATIONS

152nd RG, Nevada Air National Guard

Reno, Nevada

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Benzene was detected at concentrations ranging from 1.1 to 481 μg/L in 21 of the 150 samples analyzed, toluene from 1.0 to 2,428 μg/L in 48 of the samples, ethylbenzene from 5.4 to 1,692 μg/L in 65 of the samples, total xylenes from 1.5 to 897 μg/L in 68 of the samples, and total BTEX from 2 to 2,750.3 μg/L in 70 of the samples. The areal extent of benzene, toluene, ethylbenzene, and xylenes at 2 and 5 feet BLS is shown on Figures 5.4 to 5.11. As seen on Figures 5.4 and 5.5, benzene has a limited areal extent but is concentrated under the rows of parked aircraft. The areal extent of toluene is shown on Figures 5.6 and 5.7. Toluene has a larger areal extent which is concentrated under the aircraft parking areas and which also decreases with depth. The highest concentration of toluene is in the general area of the old burn pit designated IRP Site No. 2. The areal extent of ethylbenzene and xylenes are shown on Figures 5.8 through 5.11. Both ethylbenzene and the xylenes have similar areal extents and concentrations. Like both benzene and toluene, ethylbenzene and xylenes are concentrated under parked aircraft; however, there is a high concentration around soil organic vapor (SOV) point 31.

Total FID volatiles were detected in concentrations ranging from 11 to 103,370 μg/L in 72 of the samples. Total FID reading includes all volatiles from C_2 to C_{11}. The areal extent of total BTEX and total FID volatiles is shown on Figures 5.12 to 5.15. The highest concentrations of BTEX and total FID volatiles were detected in soil vapor samples collected from sampling locations located under aircraft (sampling location numbers 7, 8, 20, 21, 32, 33, 45, 46, 58, and 59). High concentrations were also detected in soil vapor samples collected from sampling location numbers 9 and 12 which are in the vicinity of the old burn pit designated IRP Site No. 2. A high concentration was also detected in samples collected from sampling location number 31. No aircraft were reported to have been parked over this location; however, an oil stain was noted on the concrete approximately 10 feet away. Non-detect readings were reported in samples collected from sampling locations at the east and south boundaries of the parking apron. Concentrations of various levels were reported along the north and west boundaries.

Figure 5.16 shows the location of N-S profiles of benzene, total BTEX, and total FID across the site. Profiles are shown on Figures 5.17 through 5.19. Profile A-A' (Figure 5.17) is located along the western edge of the parking apron. High Total FID peaks at SOV sampling location

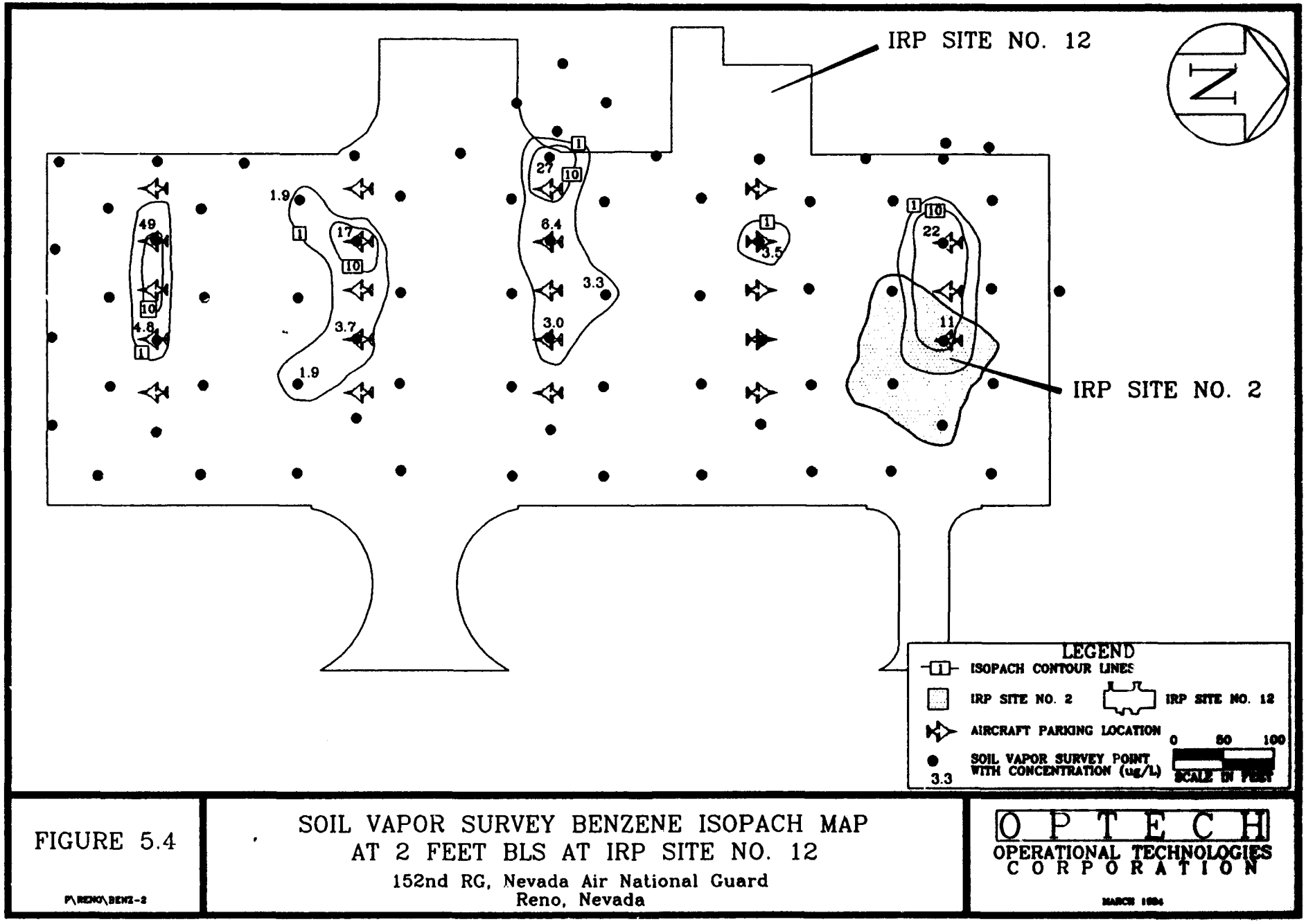

FIGURE 5.4

F:\RENO\BENZ-2

SOIL VAPOR SURVEY BENZENE ISOPACH MAP
AT 2 FEET BLS AT IRP SITE NO. 12

152nd RG, Nevada Air National Guard
Reno, Nevada

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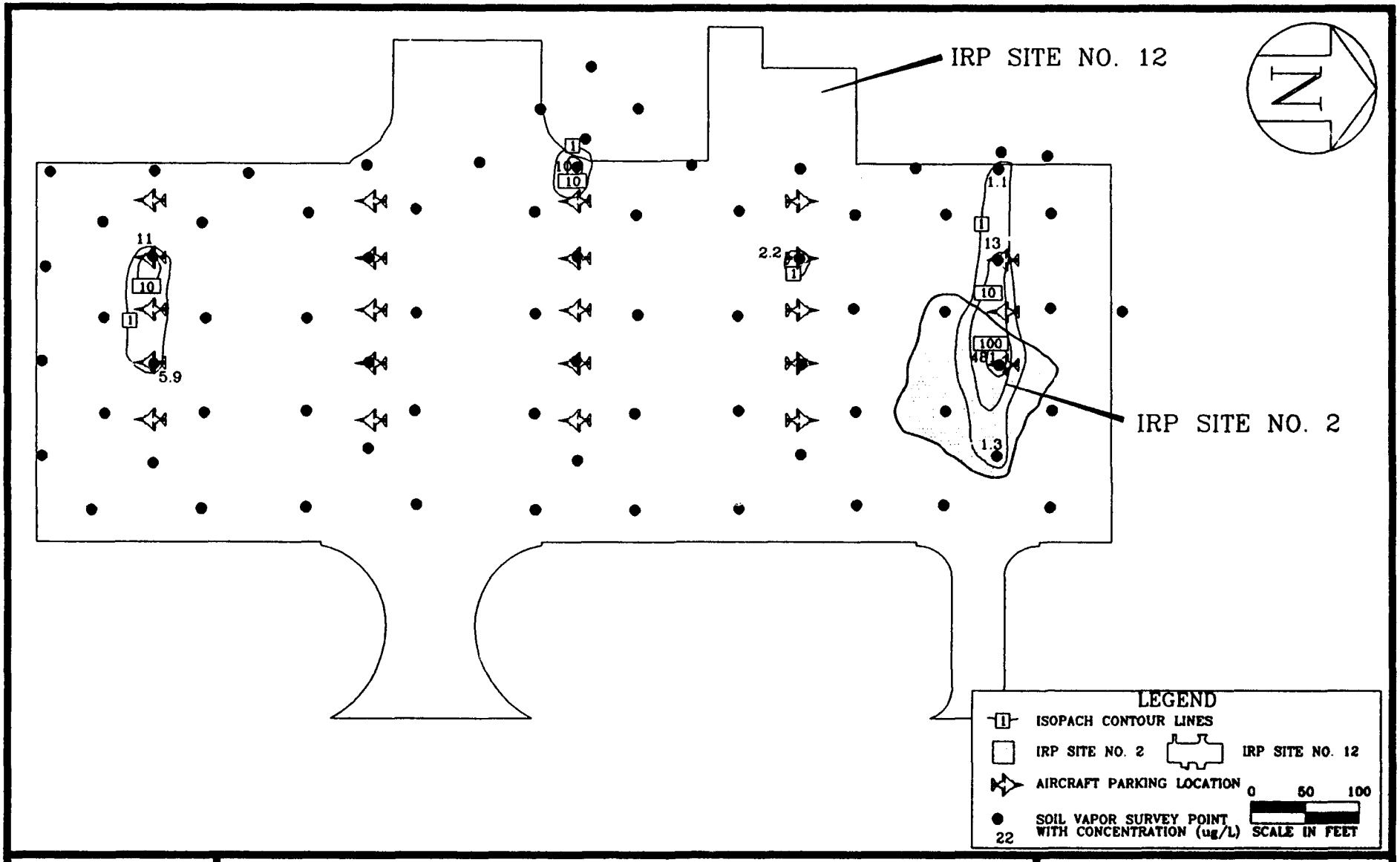

FIGURE 5.5

M:\RENO\RN06-6BE

SOIL VAPOR SURVEY BENZENE ISOPACH MAP
AT 5 FEET BLS AT IRP SITE NO. 12
152nd RG, Nevada Air National Guard
Reno, Nevada

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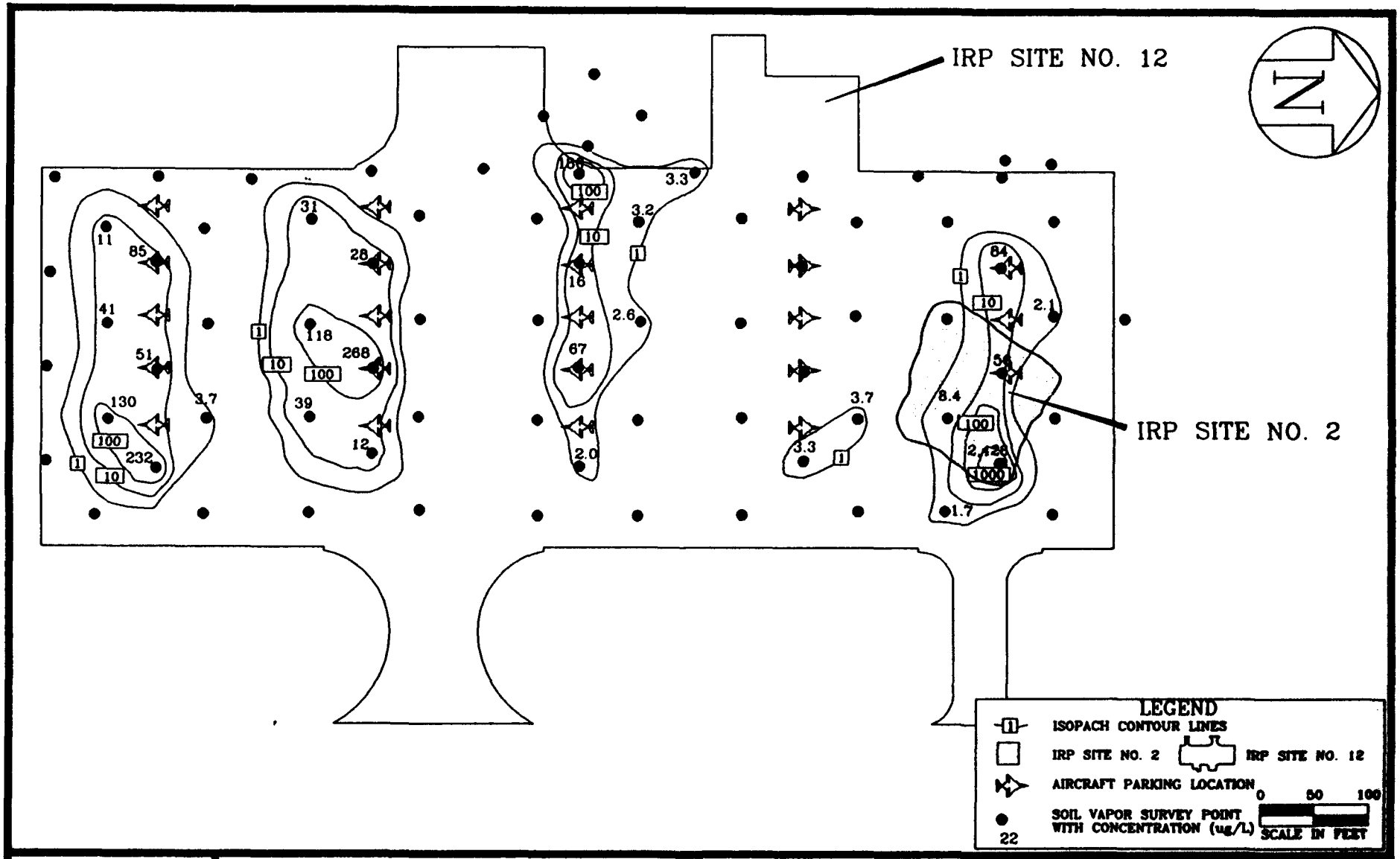

FIGURE 5.6

SOIL VAPOR SURVEY TOLUENE ISOPACH MAP
AT 2 FEET BLS AT IRP SITE NO. 12

152nd RG, Nevada Air National Guard
Reno, Nevada

M:\RENO\RN05-6T0

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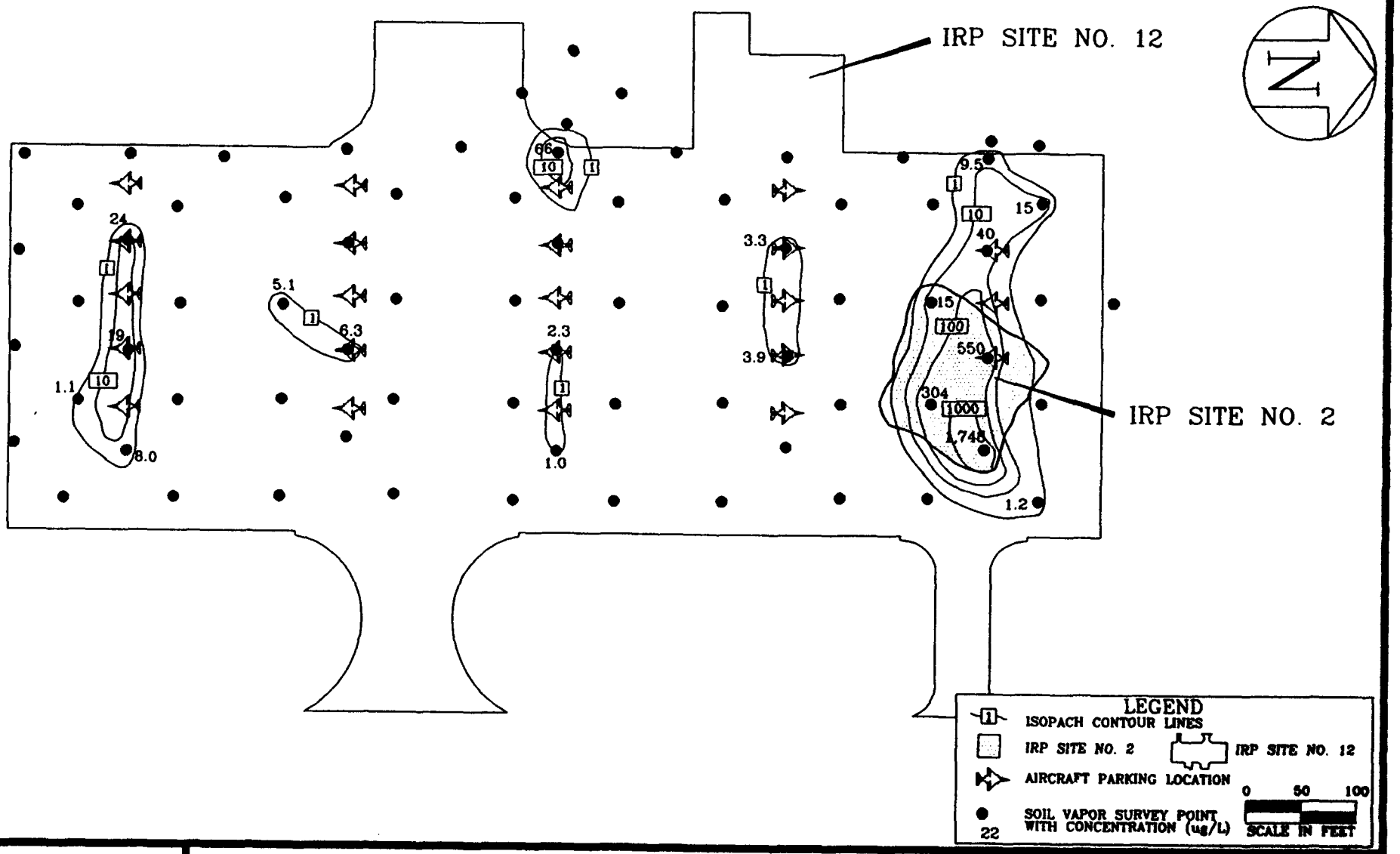

FIGURE 5.7

SOIL VAPOR SURVEY TOLUENE ISOPACH MAP
AT 5 FEET BLS AT IRP SITE NO. 12
152nd RG, Nevada Air National Guard
Reno, Nevada

M:\RENO\RN06-775

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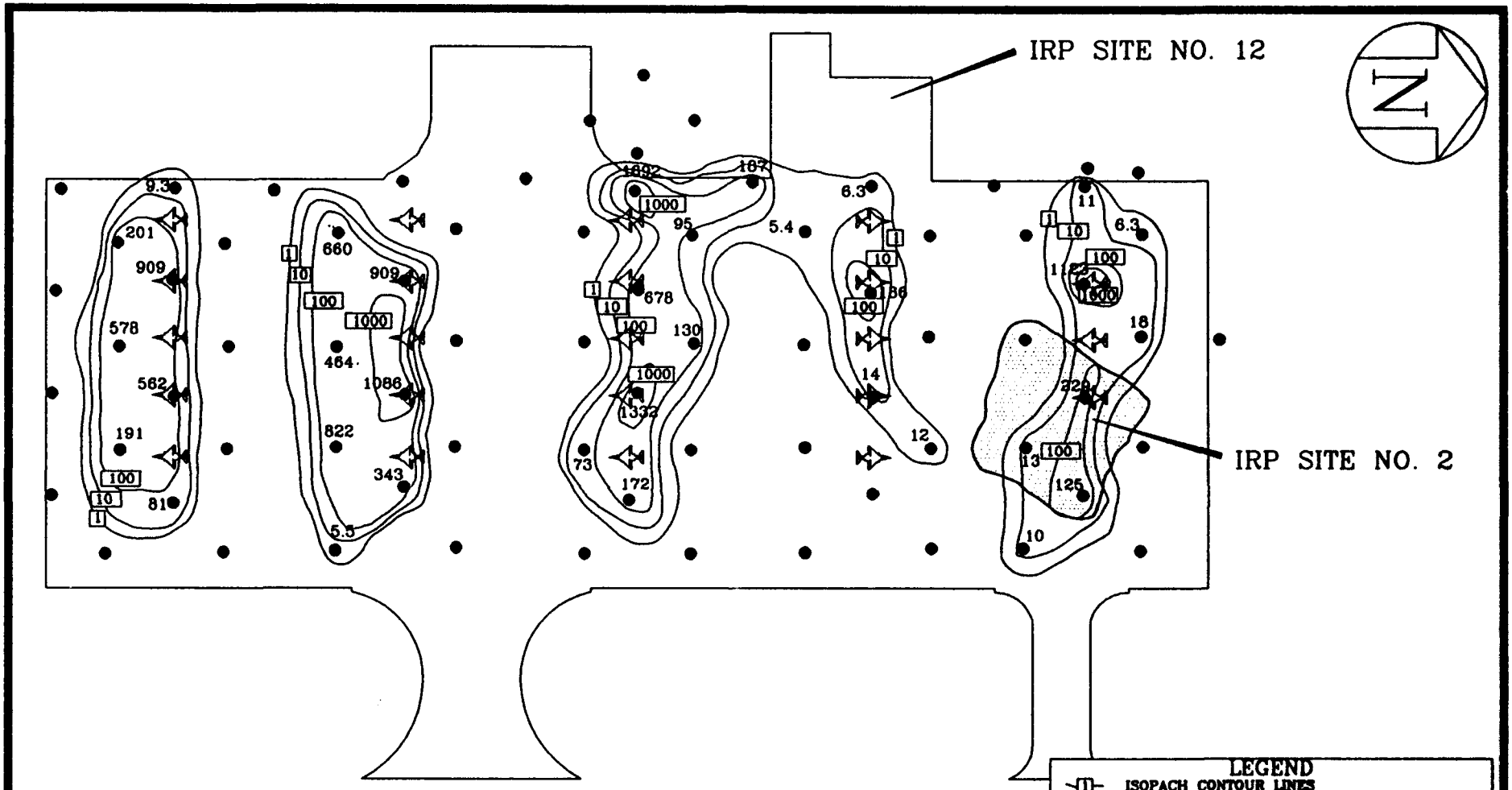

FIGURE 5.8

SOIL VAPOR SURVEY ETHYLBENZENE ISOPACH MAP
AT 2 FEET BLS AT IRP SITE NO. 12
152nd RG, Nevada Air National Guard
Reno, Nevada

M:\RENO\RNO6-SET

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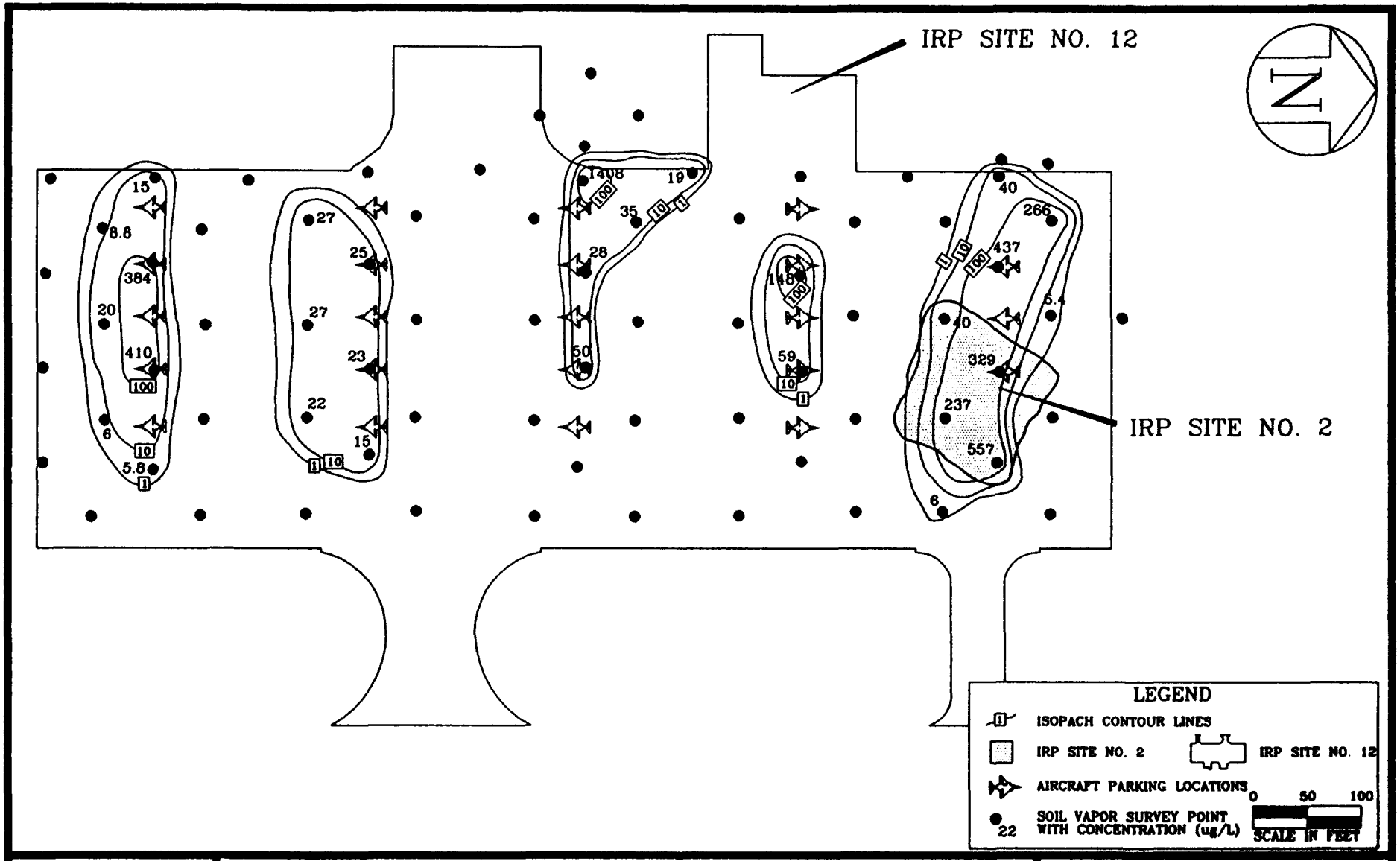

FIGURE 5.9

M\RENO\ETH-5

SOIL VAPOR SURVEY ETHYLBENZENE ISOPACH MAP
AT 5 FEET BLS AT IRP SITE NO. 12
152nd RG, Nevada Air National Guard
Reno, Nevada

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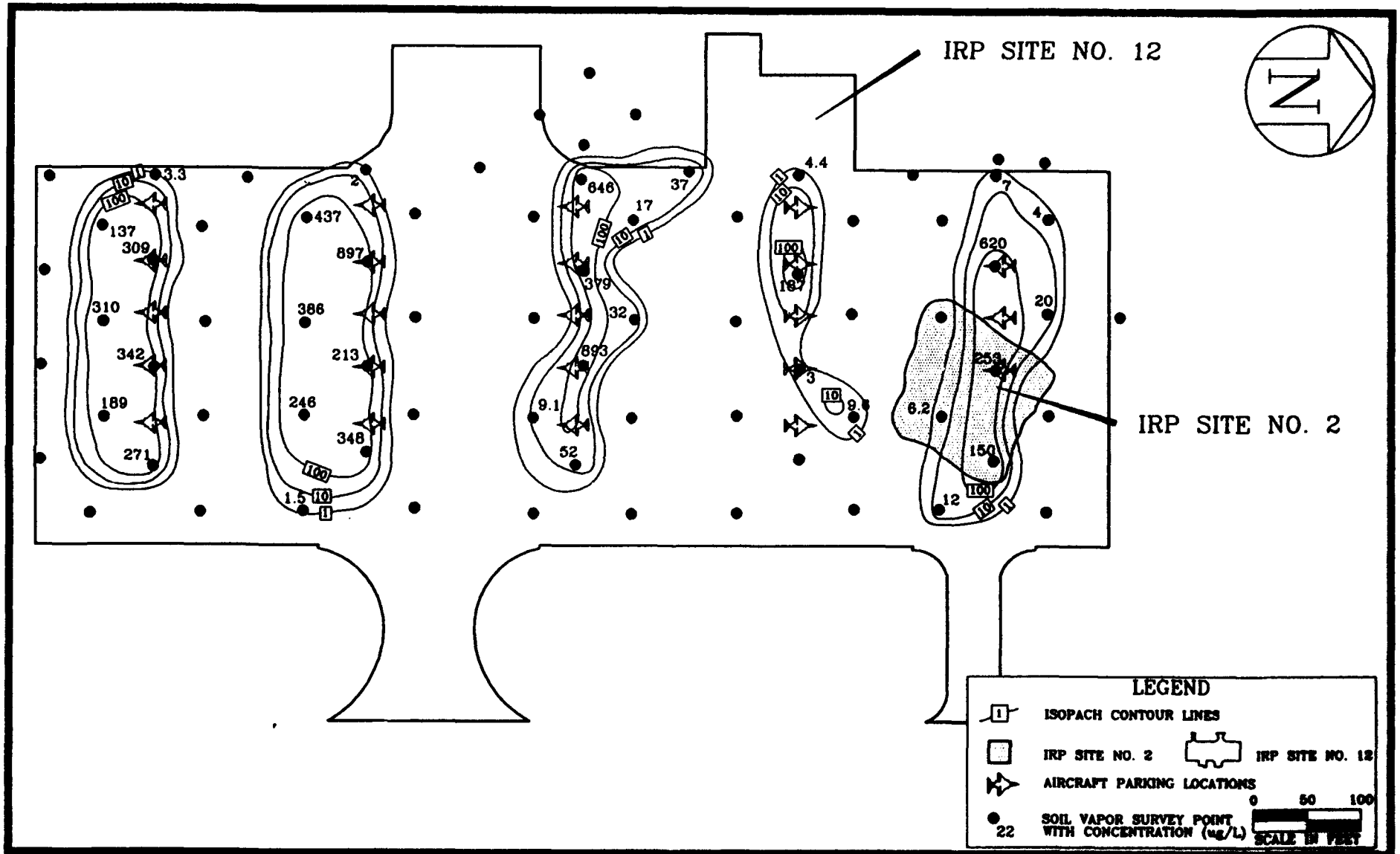

FIGURE 5.10

SOIL VAPOR SURVEY XYLENE ISOPACH MAP
AT 2 FEET BLS AT IRP SITE NO. 12
152nd RG, Nevada Air National Guard
Reno, Nevada

OPTECH
OPERATIONAL TECHNOLOGIES CORPORATION

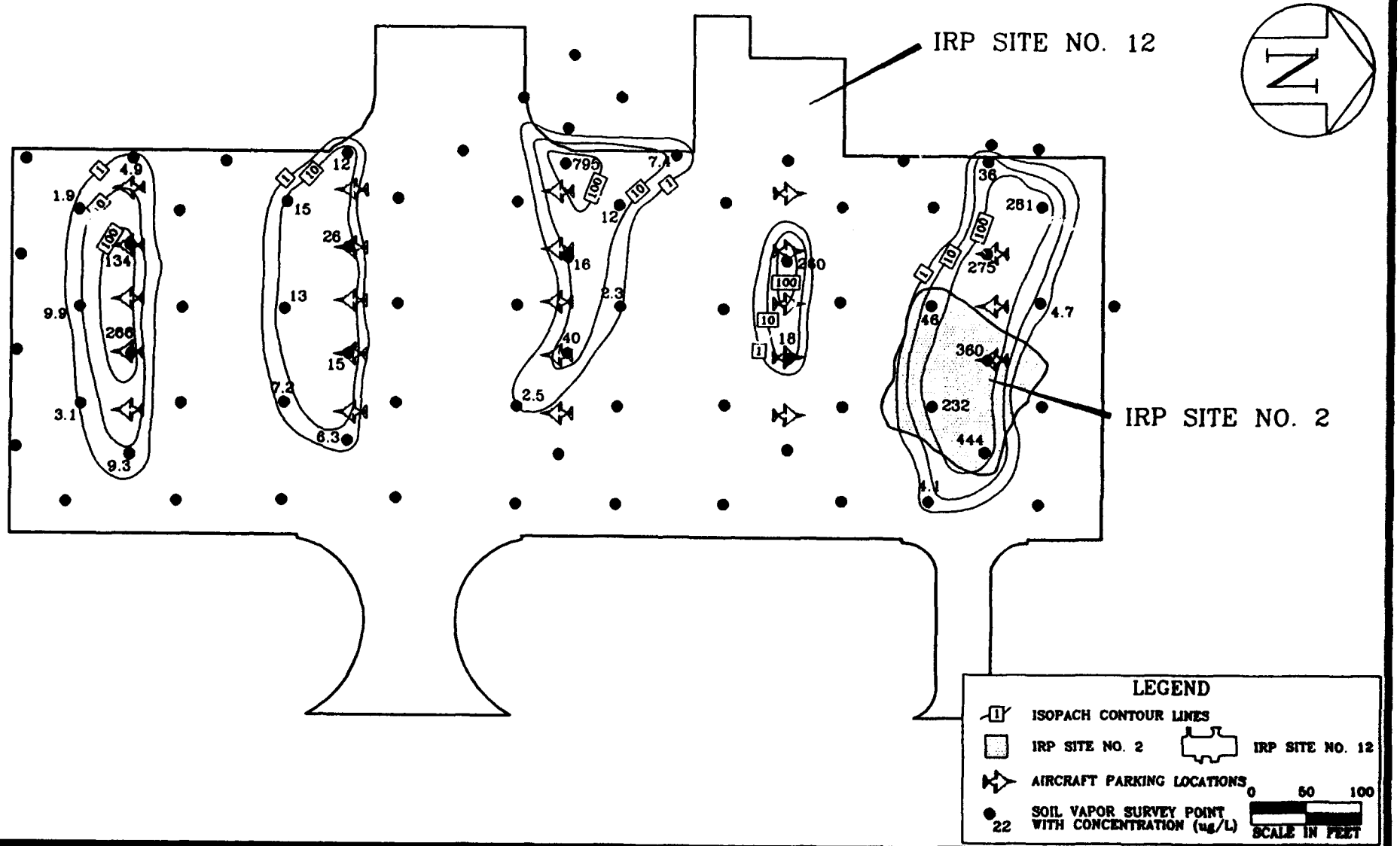

FIGURE 5.11

M:\RENO\XYL-6

SOIL VAPOR SURVEY XYLENE ISOPACH MAP
AT 5 FEET BLS AT IRP SITE NO. 12
152nd RG, Nevada Air National Guard
Reno, Nevada

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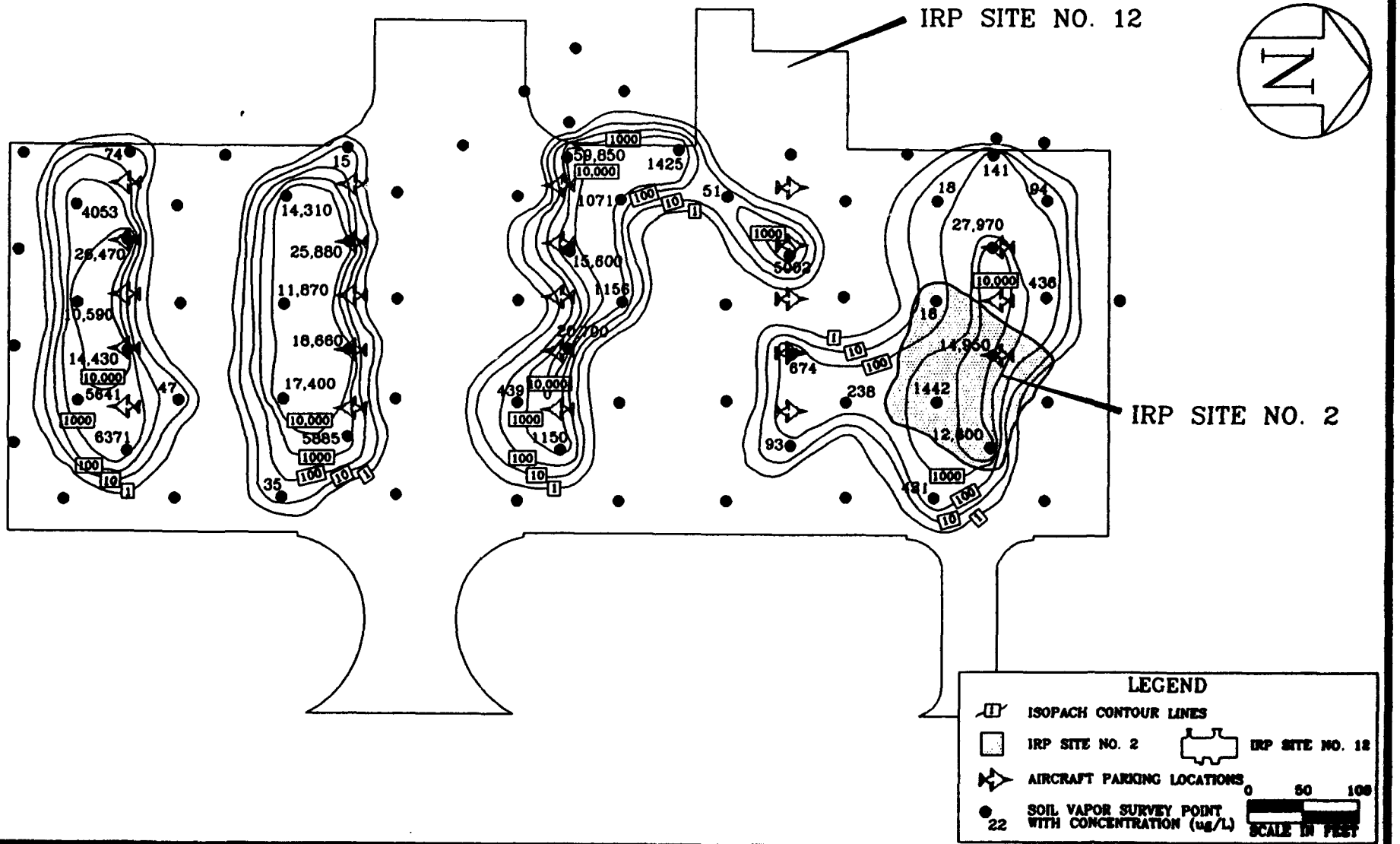

FIGURE 5.12

M:\RENO\FID-2

SOIL VAPOR SURVEY FID (VOLATILE) ISOPACH MAP AT 2 FEET BLS AT IRP SITE NO. 12

152nd RG, Nevada Air National Guard
Reno, Nevada

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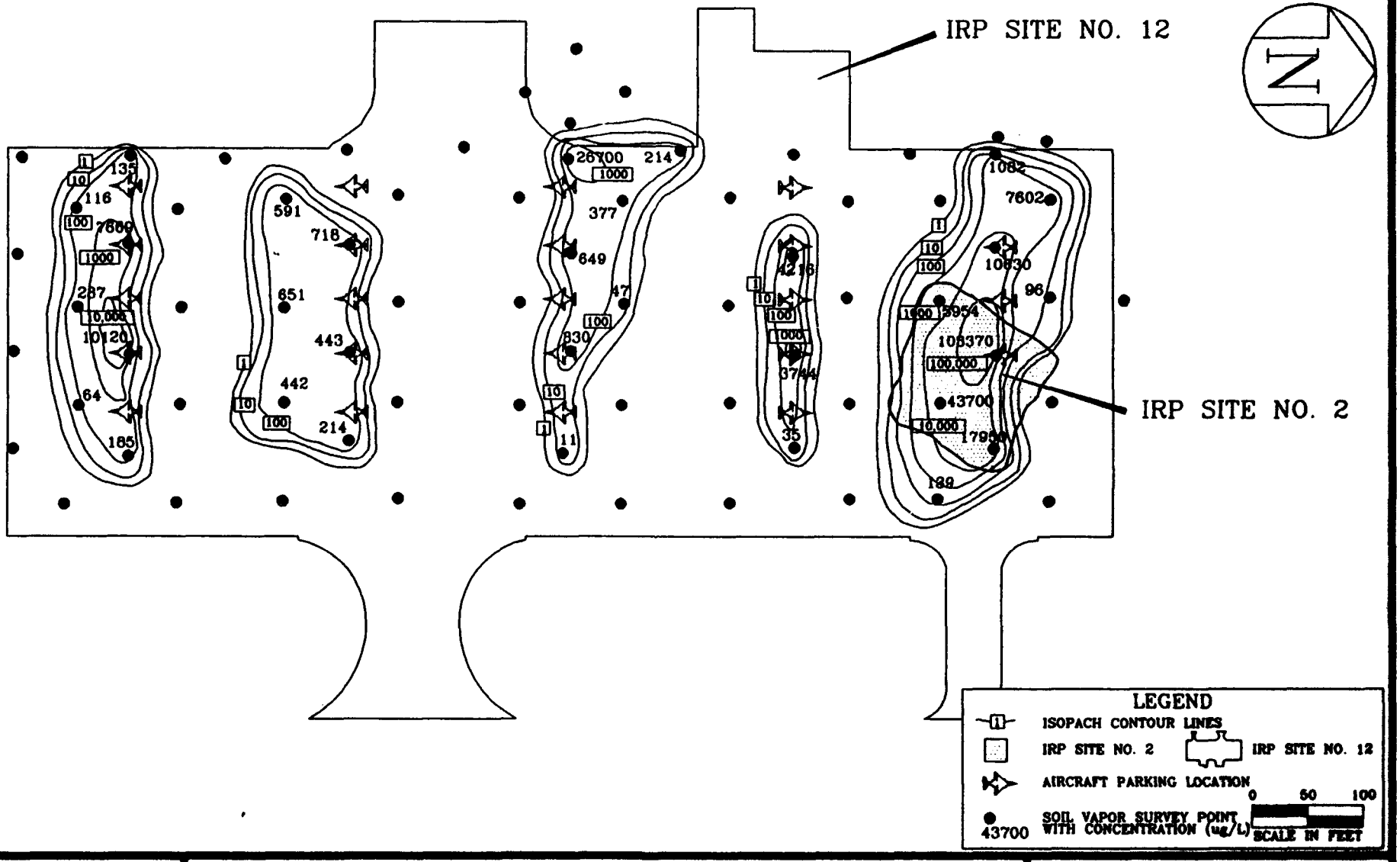

FIGURE 5.13

M:\RENO\FID-5

SOIL VAPOR SURVEY FID (VOLATILE) ISOPACH MAP
AT 5 FEET BLS AT IRP SITE NO. 12
152nd RG, Nevada Air National Guard
Reno, Nevada

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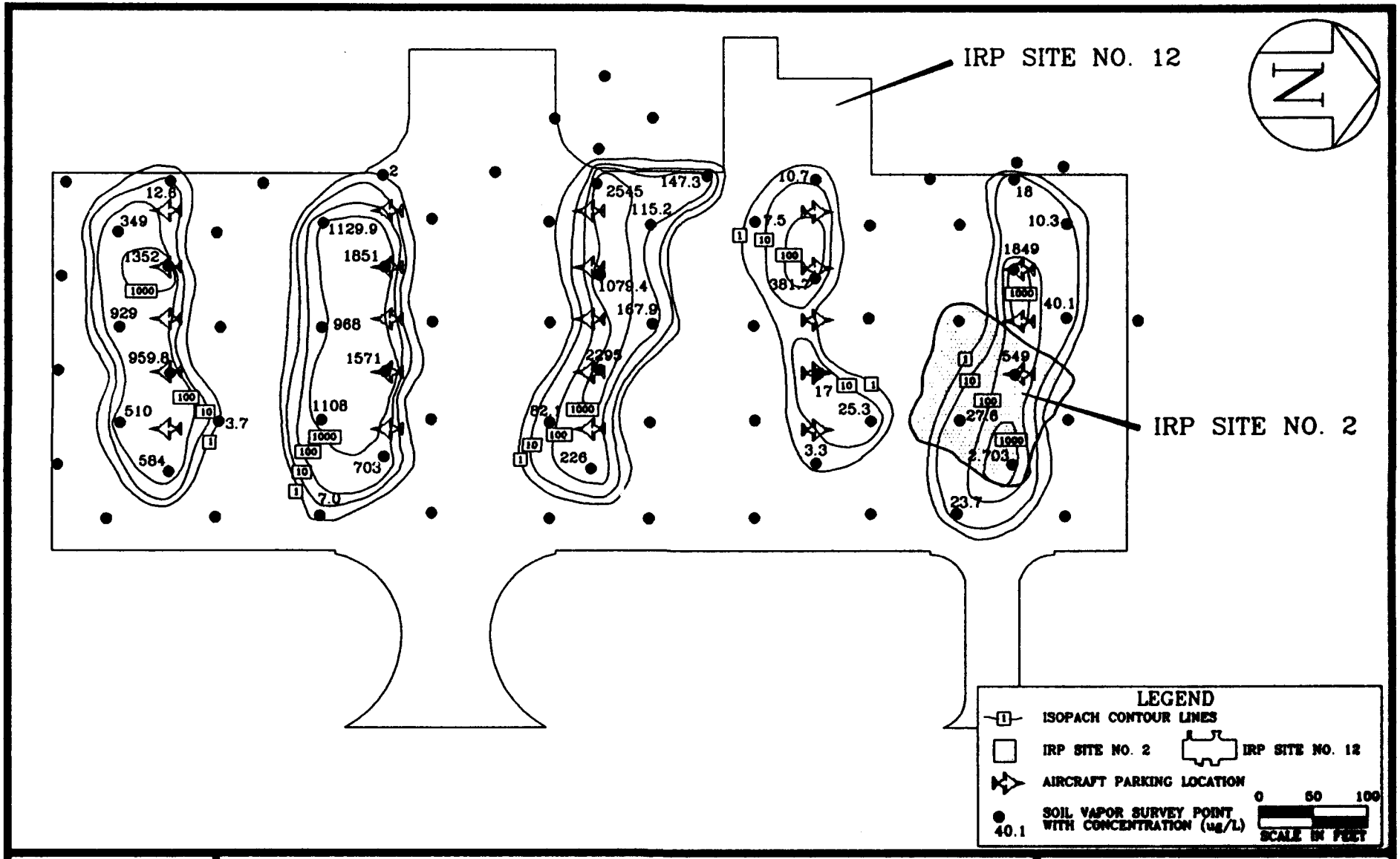

FIGURE 5.14

M\RENO\BTEX-2

SOIL VAPOR SURVEY TOTAL BTEX ISOPACH MAP
AT 2 FEET BLS AT IRP SITE NO. 12
152nd RG, Nevada Air National Guard
Reno, Nevad.

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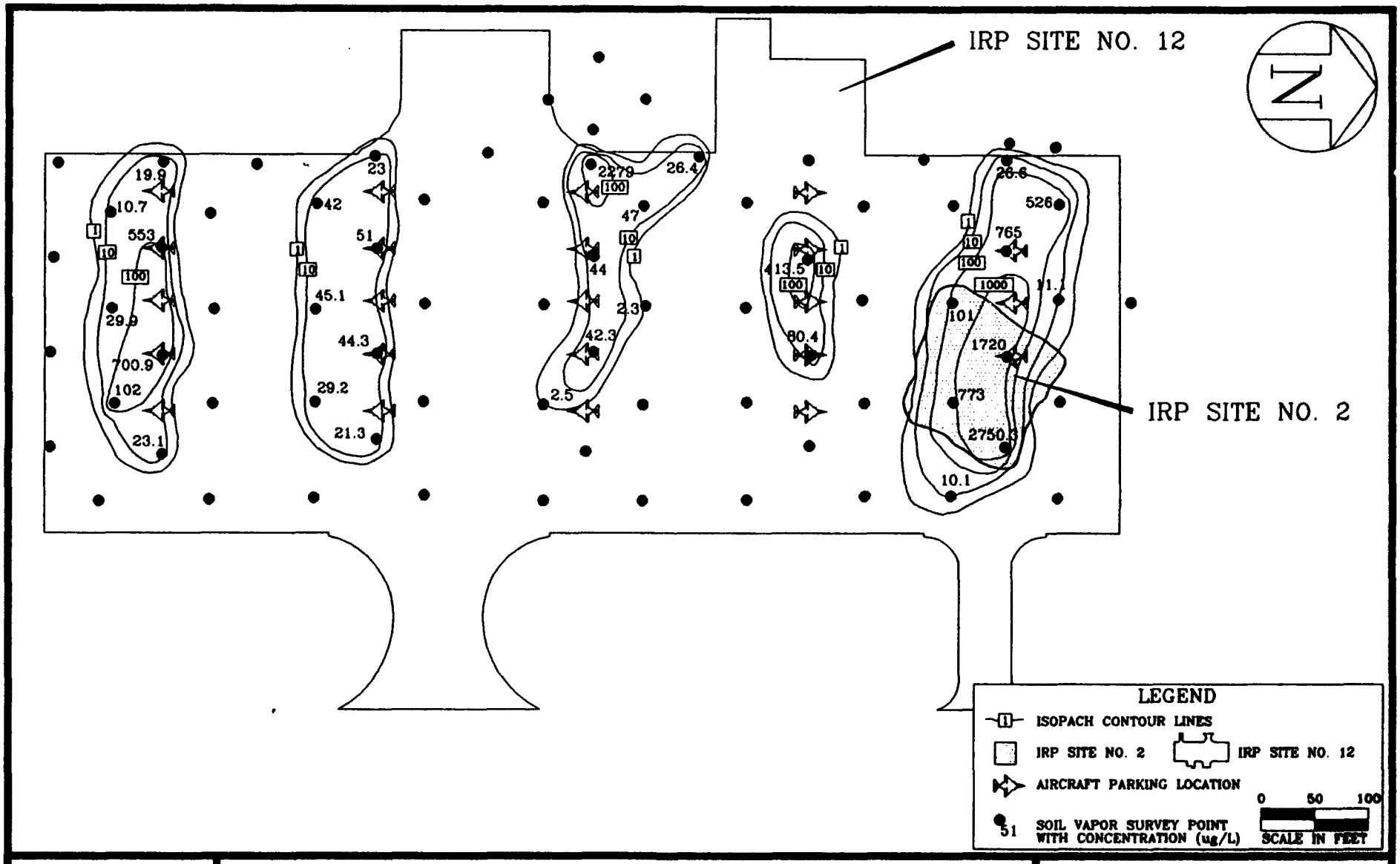

FIGURE 5.15

M\RENO\BTEX-5

SOIL VAPOR SURVEY TOTAL BTEX ISOPACH MAP
AT 5 FEET BLS AT IRP SITE NO. 12

152nd RG, Nevada Air National Guard
Reno, Nevada

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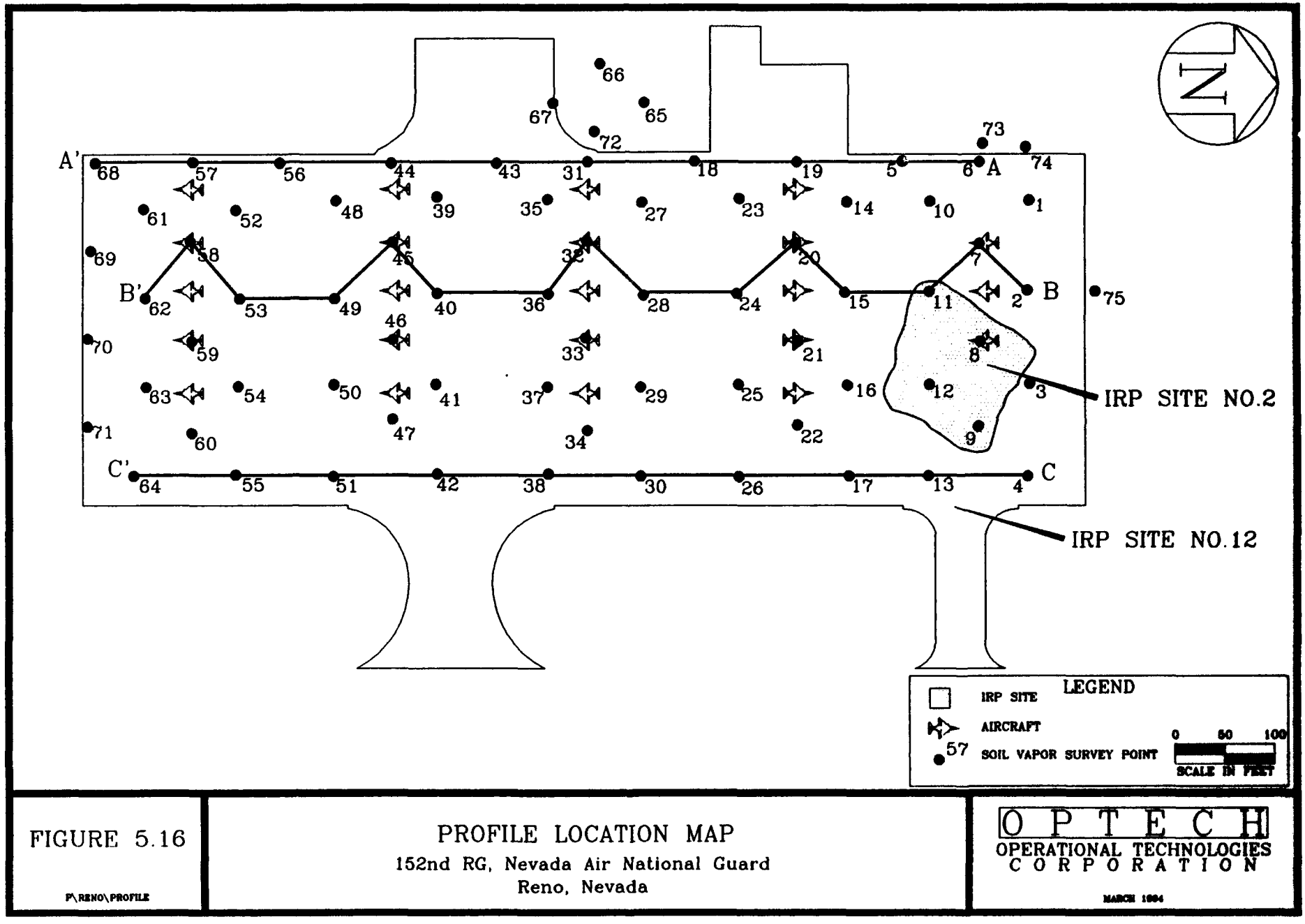

FIGURE 5.16

P\RENO\PROFILE

PROFILE LOCATION MAP

152nd RG, Nevada Air National Guard

Reno, Nevada

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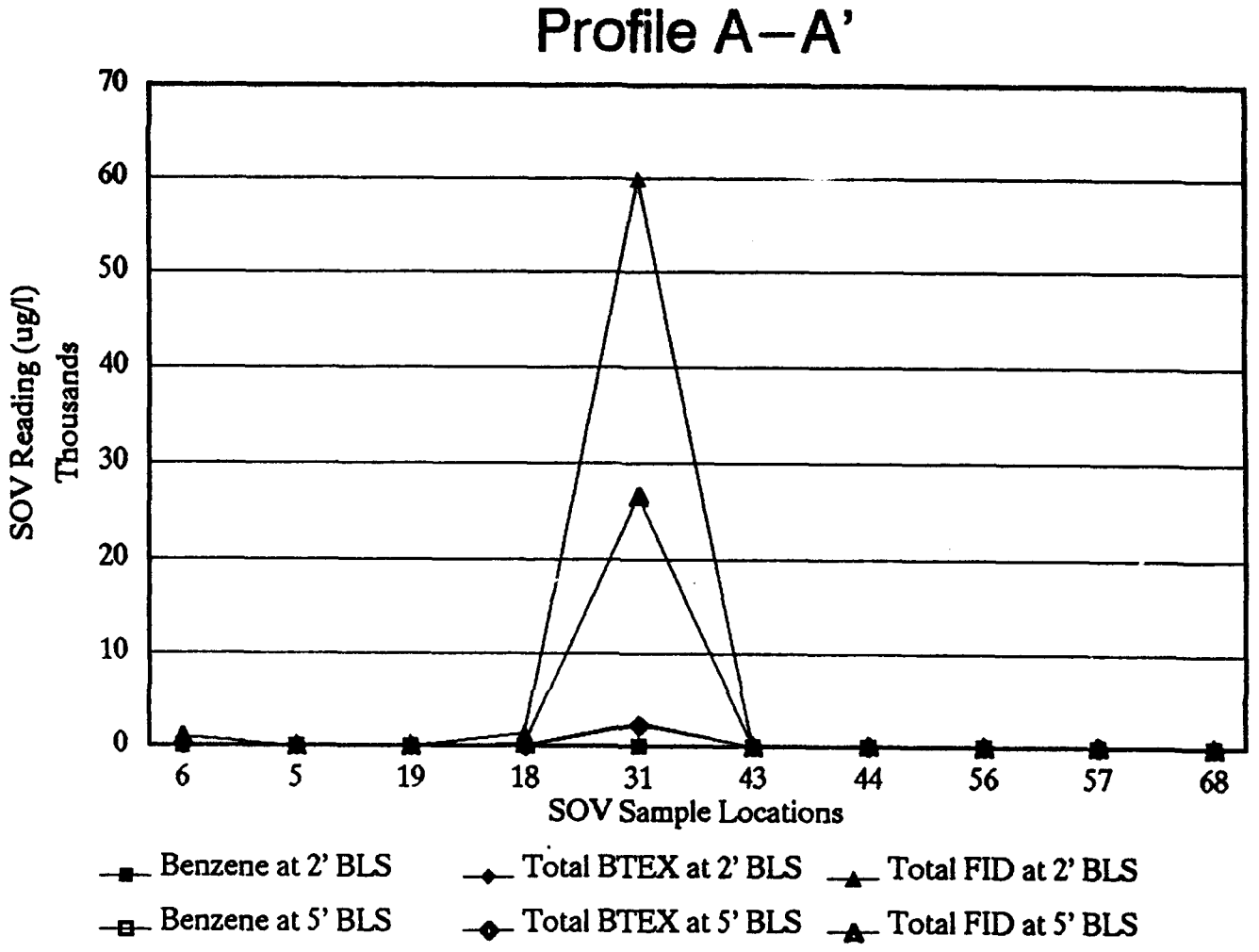

FIGURE 5.17 R\RENO\PROFILE	PROFILE A–A' 152nd RG, Nevada Air National Guard Reno, Nevada	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION MARCH 1994

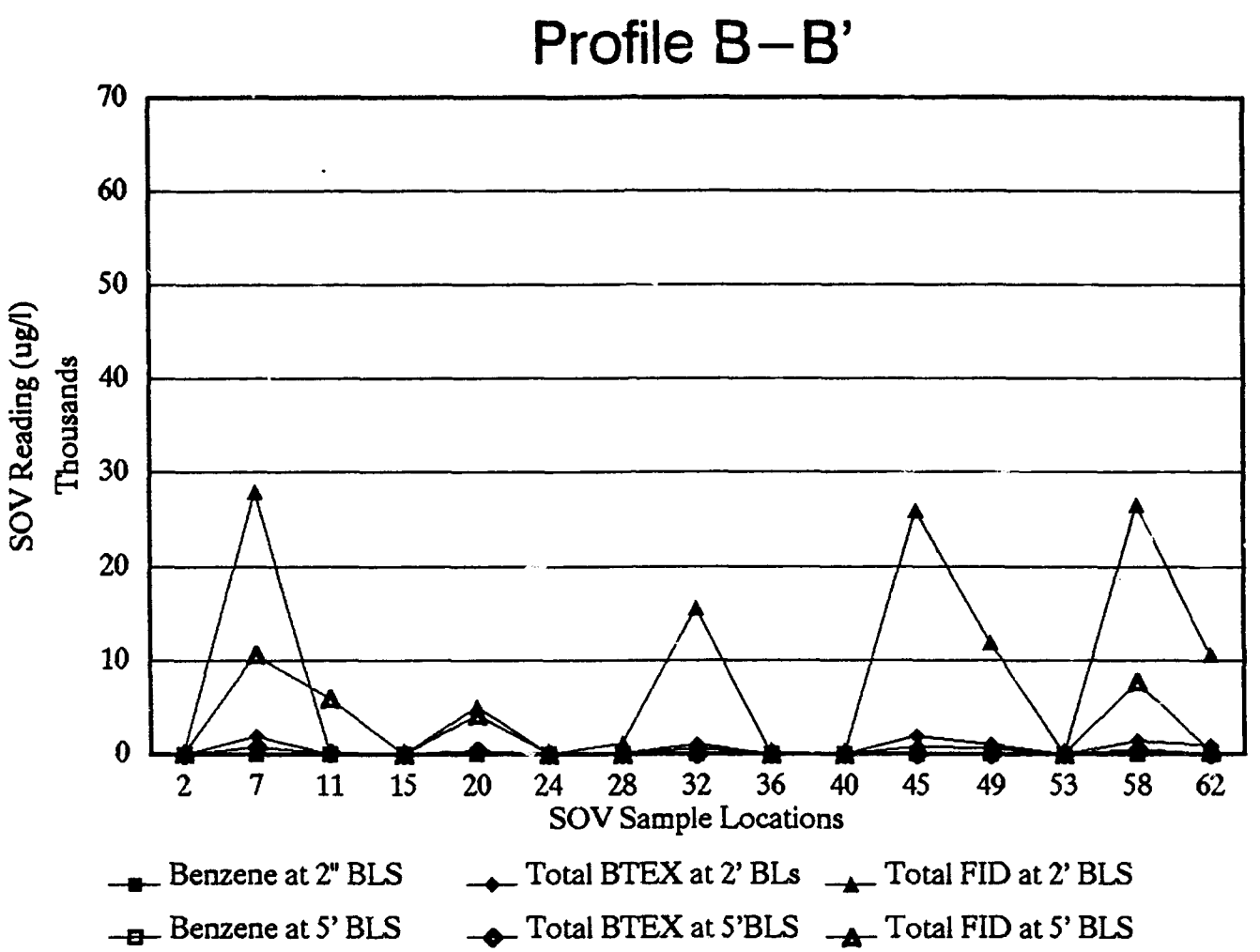

FIGURE 5.18 R\RENO\PROFILE	PROFILE B–B' 152nd RG, Nevada Air National Guard Reno, Nevada	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION MARCH 1994

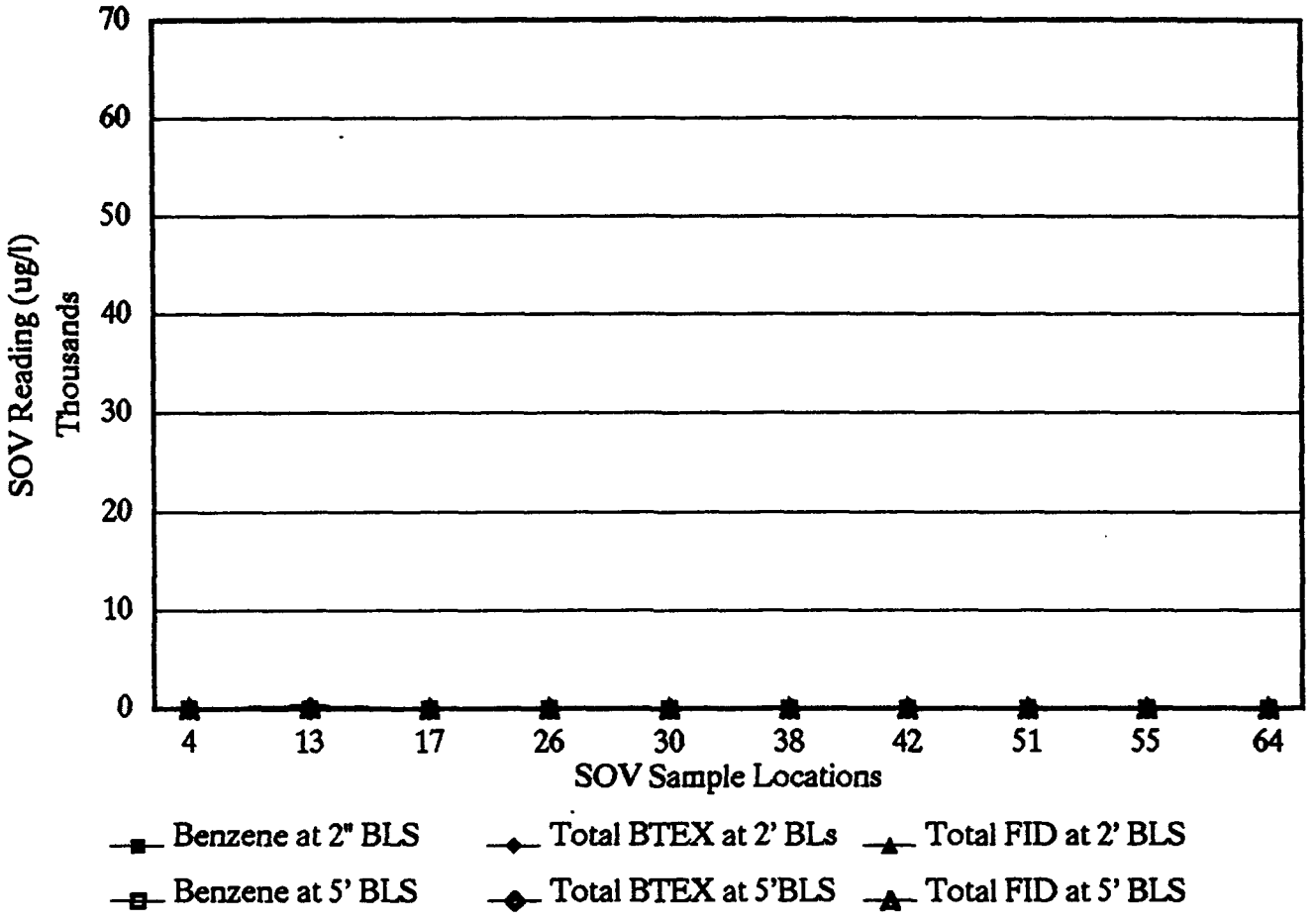

FIGURE 5.19 R\RENO\PROFILE	PROFILE C–C' 152nd RG, Nevada Air National Guard Reno, Nevada	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION MARCH 1994

31 are prominently displayed. Benzene, Total BTEX, and Total Fid levels at all other locations along the western edge of the site are very low or non-detect. Profile B-B' (Figure 5.18) is located through the center of the site. Direction of the profile was zigzagged to represent locations both under aircraft and in the open. As seen on Figure 5.16, SOV sampling locations 7, 20, 32, 45, and 58 are under aircraft parking slots. Profile B-B' (Figure 5.18) shows substantially higher peaks for total FID under the aircraft parking slots. Profile C-C' (Figure 5.19) is located along the eastern edge of the parking apron and downgradient of the site. Profile C-C' reflects predominately non-detected reading along the eastern edge.

5.2.2.2 Field GC Screening Results

Forty-nine soil samples, 18 collected from six soil borings (BH35, BH36, BH37, BH38, BH39, and BH40) during the October - November 1993 field activities, 14 collected from the six twin soil borings (BH 35A, BH36A, BH37A, BH38A, BH39A, and BH40A) during the January 1994 field activities, seven collected from the two borings needed to install monitoring wells MW26 (the abandoned first attempt and successful second attempt), and MW27; and ten groundwater samples from monitoring well sampling were field screened with a Photovac 10S55 Portable GC. The GC had been calibrated to screen for BTEX. Table 5.2 summarizes the maximum BTEX concentration detected in soil and groundwater samples. Complete GC data is included in Appendix C.

Table 5.2
Maximum BTEX Concentrations Detected by GC in Soil and Groundwater Samples
152nd RG, Nevada Air National Guard, Reno, Nevada

Compound	Maximum Concentrations Detected in Soil (ppm)	Maximum Concentrations Detected in Groundwater (ppm)
Total BTEX	10.630	0.0
Benzene	0.835	0.0
Toluene	8.831	0.0
Ethylbenzene	5.281	0.0
Xylenes	4.894	0.0

GC – Gas Chromatograph.
ppm – parts per million.

5.2.2.2.1 Soil

Total BTEX was detected at concentrations ranging from 0.007 ppm to 10.63 ppm in 19 of the 39 soil samples analyzed, benzene from 0.0008 ppm to 0.835 ppm in ten of the samples analyzed, toluene from 0.003 ppm to 8.831 ppm in 12 of the samples, ethylbenzene from 0.0003 ppm to 5.281 ppm in 12 of the samples, and xylenes from 0.001 ppm to 4.893 ppm in 12 of the samples. The highest concentrations of benzene and xylenes were detected in the soil sample BH40A, collected from a depth of 1.5 - 3.0 feet BLS. The highest concentrations of total BTEX and toluene were detected in the soil sample BH36, collected from the 1.5 - 2.5 feet BLS interval. The highest concentration of ethylbenzene was detected in the soil sample BH40, collected from the 2.0 - 3.0 feet BLS interval.

5.2.2.2.2 Water

BTEX compounds were not detected by GC analysis in groundwater sampled from monitoring wells MW27, MW26, MW24, MW08 and MW2.

5.2.3 Soil Investigation Findings

Soil samples were collected from 12 soil borings (six original soil borings and six twinned soil borings) and two monitoring wells. Thirty-three investigative soil samples were submitted for laboratory analysis to provide an assessment of the presence and type of soil contamination existing at IRP Site No. 12. Four samples were collected for microbiological analyses and two were collected for geotechnical analyses.

5.2.3.1 Soil Boring Locations

Six soil borings (BH35 through BH40) were installed at the site to obtain soil samples for laboratory analysis for defining any existing soil contamination, and to aid in defining the vertical and horizontal extent of contamination. Due to exceeding VOC hold times, these borings were twinned (BH35A through BH40A). Soil samples were also used to characterize

site geology and subsurface soil conditions. The location of the six original soil borings (BH35, BH36, BH37, BH38, BH39, and BH40) proposed in the work plan were decided upon after a review of soil vapor survey results. The six twin soil borings (BH35A, BH36A, BH37A, BH38A, BH39A, and BH40A) were located within 2 or 3 feet of the respective original soil borings.

Soil borings BH35 and BH36 were located in aircraft parking slots in the E Row, 2nd Slot (E2) and in the A3 slot, respectively (parking slots shown in Figure 5.2). The purpose of these two soil borings was to confirm the nature and extent of contamination under parking slots. Upon a request from the Base Civil Engineering Office, soil borings were not located within 2 feet of a slab joint. Soil boring BH37 was located just off the north edge of the parking apron to get an indication of conditions away from any suspected area of contamination. Soil borings BH38 and BH39 were located just off the edge of the parking apron, between the parking apron and the POL area, to delineate any possible contamination migrating from the POL area to the parking apron. BH40 was located at SOV survey location number 31, which had high BTEX and total FID volatile readings and where an oil stain was visible on the concrete. The locations of all soil borings are shown in Figure 5.20.

5.2.3.2 Subsurface Geology

Soil samples collected from 12 soil borings (six original soil borings and six twinned soil borings) and two monitoring wells were used to provide geologic information for describing the subsurface geology at the Base and for the site. Lithologic logs for the holes drilled during this investigation are presented in Appendix D.

The upper 2 to 3 feet of the boreholes located under the concrete parking apron is predominantly a sandy, silty, gravelly fill. Beneath the fill, natural floodplain deposits of clayey silts were encountered to depths varying from 7 to 8 feet BLS. A water-bearing sand was encountered below the clayey silts. Cross-sections depicting the subsurface geology are indexed in Figure 5.21 and shown in Figures 5.22, 5.23, and 5.24.

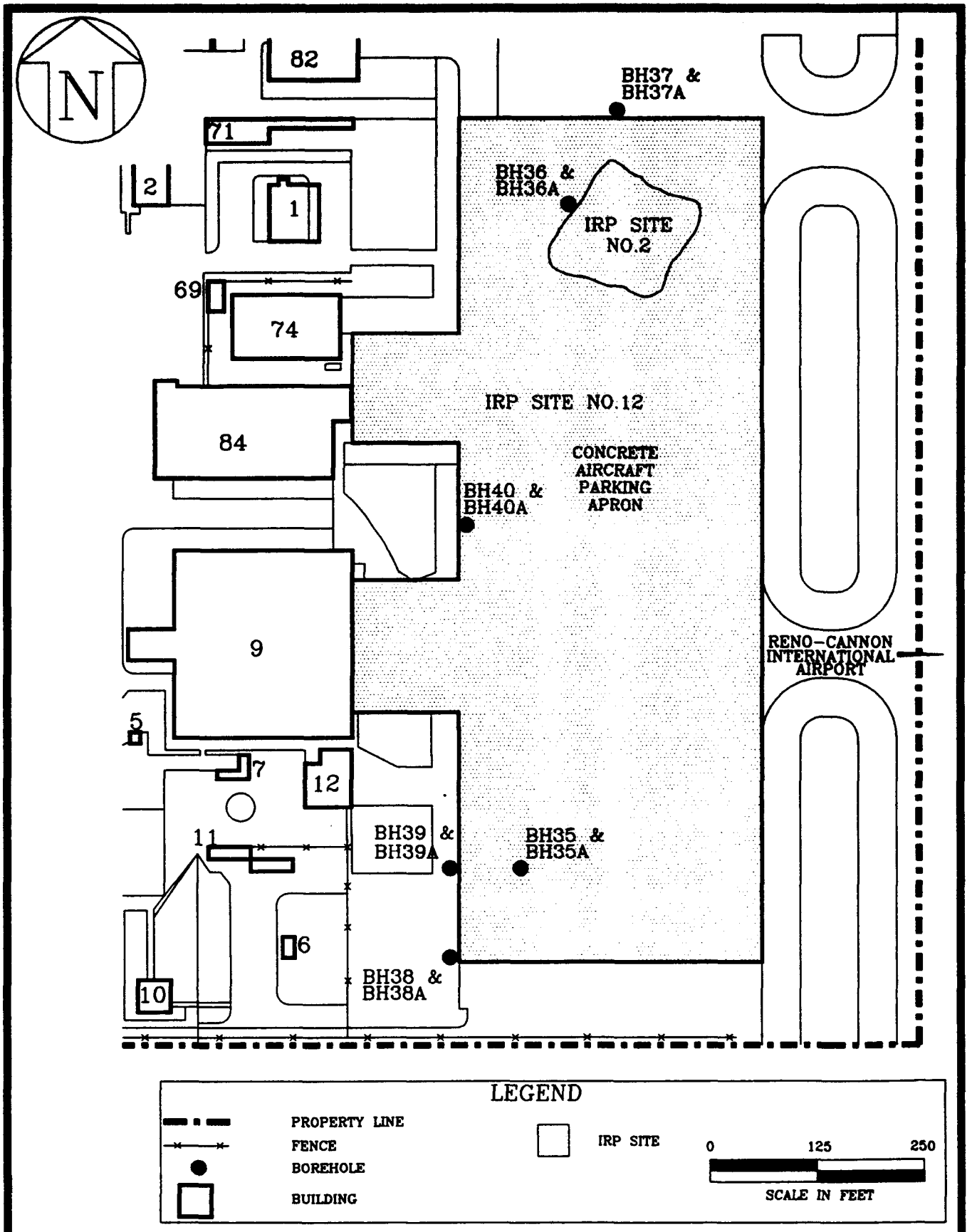

FIGURE 5.20

SOIL BORING LOCATIONS
152nd RG, Nevada Air National Guard
Reno, Nevada

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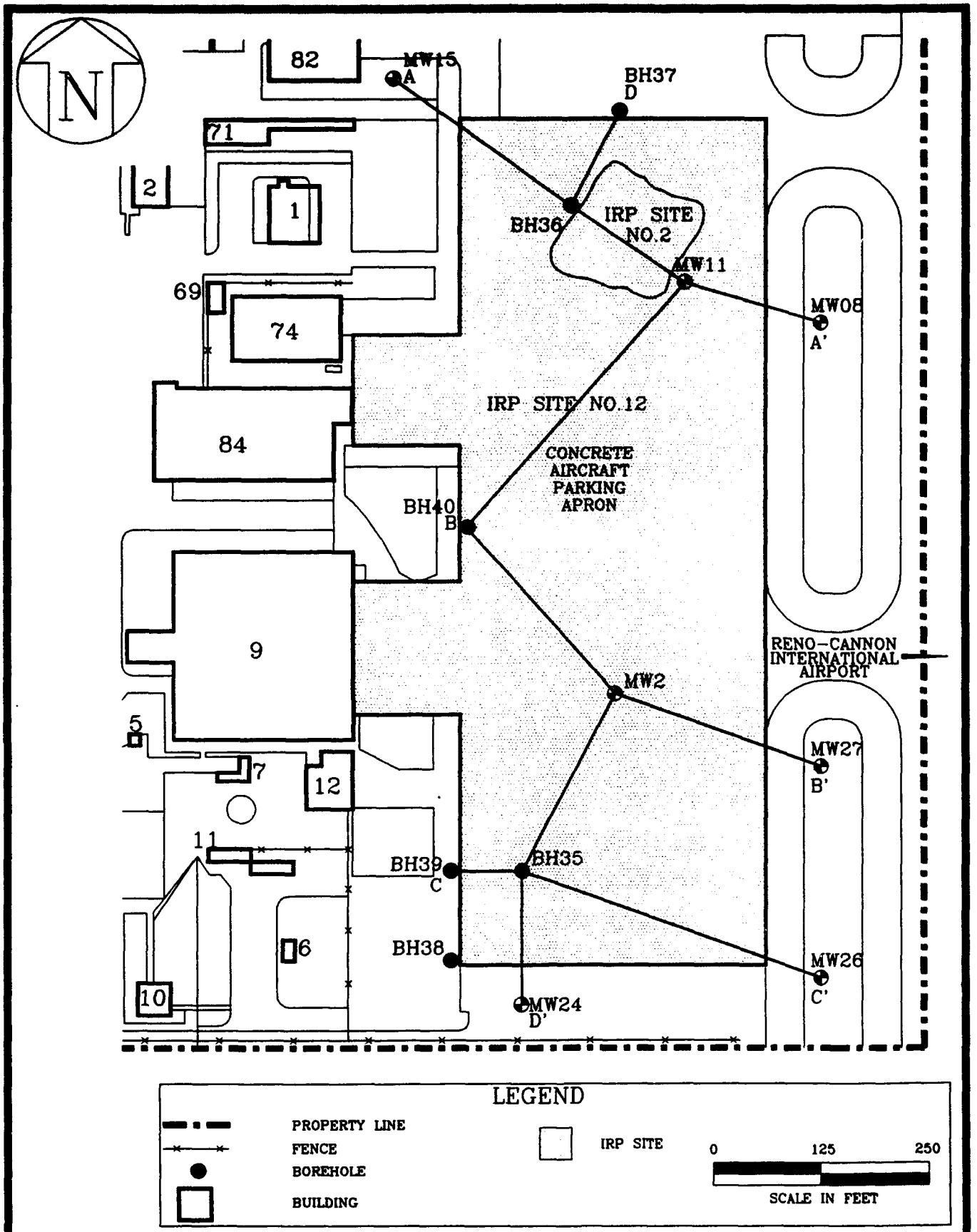

FIGURE 5.21

M:\RENO\CROSSMAP

CROSS SECTION LOCATION MAP

152nd RG, Nevada Air National Guard
Reno, Nevada

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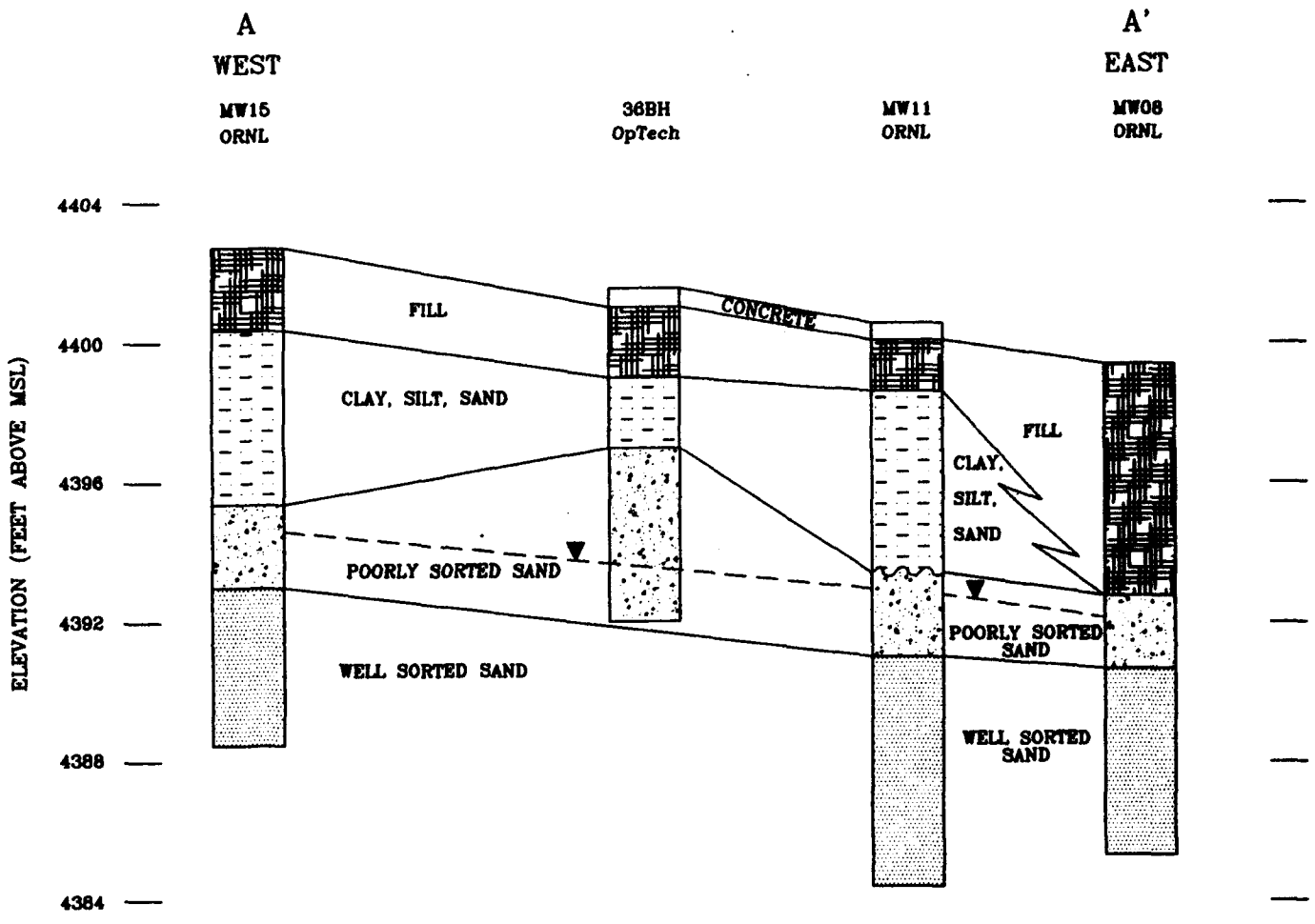

NOTE: POTENTIOMETRIC DATA FROM MONITORING WELLS ONLY. DUE TO THE SEMI-CONFINING NATURE OF THE AQUIFER, GROUNDWATER WAS NOT ENCOUNTERED IN BOREHOLES.

▼ POTENTIOMETRIC SURFACE

FIGURE 5.22

M\RENO\XSCT-AA

GEOLOGIC CROSS SECTION A–A'

152nd RG, Nevada Air National Guard
Reno, Nevada

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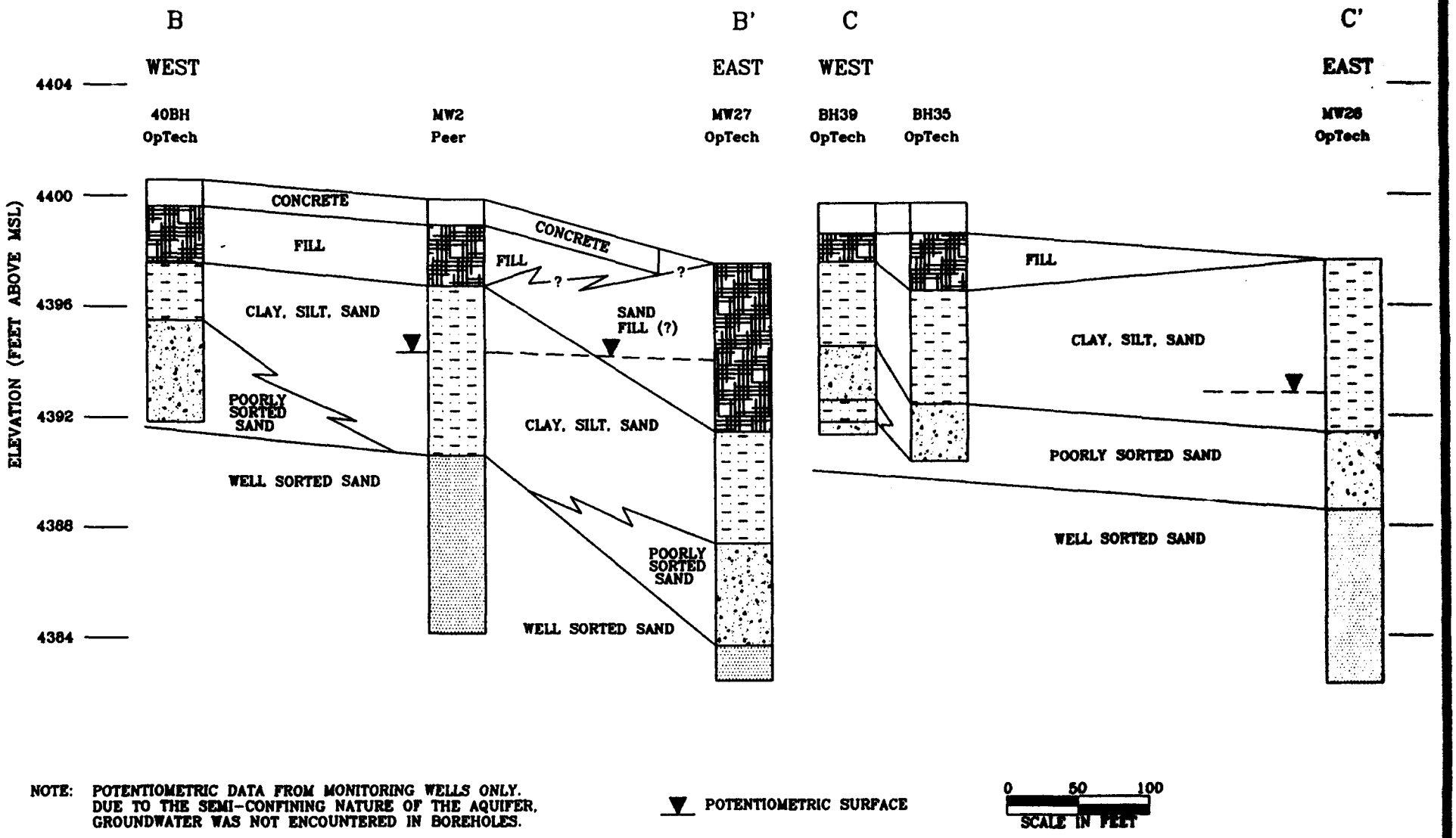

NOTE: POTENTIOMETRIC DATA FROM MONITORING WELLS ONLY. DUE TO THE SEMI-CONFINING NATURE OF THE AQUIFER, GROUNDWATER WAS NOT ENCOUNTERED IN BOREHOLES.

▼ POTENTIOMETRIC SURFACE

0 50 100
SCALE IN FEET

FIGURE 5.23

M\RENO\XSCT-B-C

GEOLOGIC CROSS SECTION B–B' & C–C'

152nd RG, Nevada Air National Guard
Reno, Nevada

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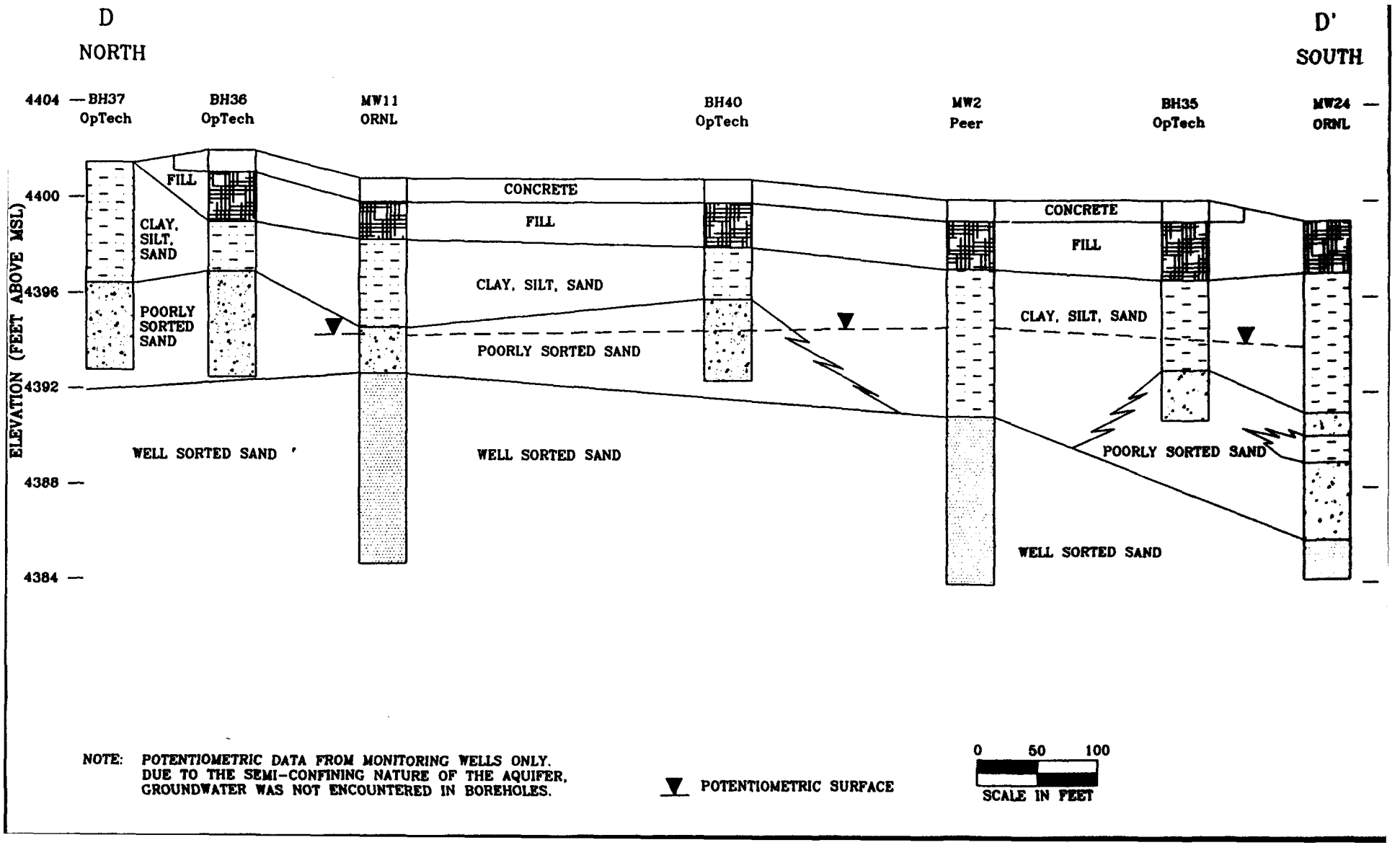
D
NORTH
D'
SOUTH
4404
BH37
OpTech
BH36
OpTech
MW11
ORNL
BH40
OpTech
MW2
Peer
BH35
OpTech
MW24
ORNL
ELEVATION (FEET ABOVE MSL)
4400
4396
4392
4388
4384
FILL
CLAY, SILT, SAND
POORLY SORTED SAND
WELL SORTED SAND
CONCRETE
FILL
CLAY, SILT, SAND
POORLY SORTED SAND
WELL SORTED SAND
CONCRETE
FILL
CLAY, SILT, SAND
POORLY SORTED SAND
WELL SORTED SAND
NOTE: POTENTIOMETRIC DATA FROM MONITORING WELLS ONLY. DUE TO THE SEMI-CONFINING NATURE OF THE AQUIFER, GROUNDWATER WAS NOT ENCOUNTERED IN BOREHOLES.
POTENTIOMETRIC SURFACE
0
50
100
SCALE IN FEET

5.2.3.3 Nature and Extent of Soil Contamination

Twelve soil borings were drilled at the site from which a total of 23 investigative samples were collected for laboratory analysis. The borings were drilled and soil samples collected from 1 November to 3 November 1993. Sample holding time for VOC analysis was exceeded by the laboratory. The six original soil borings were twinned and resampled for VOCs from 4 January to 6 January 1994. Sampling intervals submitted for laboratory analysis and the analytical program are presented in Table 5.3.

5.2.3.3.1 VOCs

Soil samples collected at IRP Site No. 12 detected VOCs. Benzene was detected at concentrations ranging from 0.006 mg/kg to 0.023 mg/kg. The highest concentration of benzene was detected in soil sampled from soil boring BH36A, located in aircraft parking slot A3. Benzene was detected only from samples collected from the two aircraft parking slots A3 and E2. Benzene was not detected in soil sampled from BH37A, BH38A, BH39A, and BH40A.

Toluene was detected at 0.004 mg/L in equipment blank 12-011RB. Results of analyses for quality control samples are presented in Appendix F, and results of analyses for investigative samples are presented in Appendix G.

Toluene was detected at concentrations ranging from 0.006 mg/kg to 0.057 mg/kg. The highest concentrations of toluene were detected in soil sampled from BH40A at concentrations ranging from 0.006 to 0.057 mg/kg, with the highest concentration detected in soil sampled from a depth of 5.0 - 6.5 feet BLS. Toluene was detected in soil samples collected from BH35A at concentrations ranging from 0.010 mg/kg to 0.012 mg/kg, with the highest concentration detected in soil sampled from a depth of 1.5 - 2.0 feet BLS. Toluene was detected in soil samples collected from BH36A at concentrations ranging from 0.008 mg/kg to 0.015 mg/kg, with the highest concentration detected in soil sampled from a depth of 1.5 - 3.0 feet BLS. Toluene was not detected in samples from borings BH37A, BH38A, and BH39A. Toluene was

Table 5.3
Soil Sampling and Analytical Program
152nd RG, Nevada Air National Guard, Reno, Nevada

Borehole Number	Sample Depth (ft BLS)	Additional Samples	Soil Analyses and Methods			
			VOCs (SW8260)	SVOCs (SW8270)	TPH (CA Mod. 8015)	Lead (SW7421)
BH35	1.5 - 2.0		X[2]	X	X	X
BH35	8.0 - 9.0		X[2]	X	X	X
BH35A	1.5 - 2.0		X	NA	NA	NA
BH35A	8.5 - 9.0		X	NA	NA	NA
BH36	1.5 - 2.5		X[2]	X	X	X
BH36	8.0 - 9.5		X[2]	X	X	X
BH36A	1.5 - 3.0		X	NA	NA	NA
BH36A	8.0 - 9.5		X	NA	NA	NA
BH37	3.0 - 4.0		X[2]	X	X	X
BH37A	2.5 - 3.0		X	NA	NA	NA
BH37A	6.5 - 8.0		X	X	X	X
BH38	2.0 - 3.5		X[2]	X	X	X
BH38	5.0 - 6.5		X[2]	X	X	X
BH38A	4.0 - 5.5		X	NA	NA	NA
BH38A	5.0 - 6.5		X	NA	NA	NA
BH39	0.5 - 1.5		X[2]	X	X	X
BH39	5.5 - 7.0		X[2]	X	X	X
BH39A	0.5 - 2.0		X	NA	NA	NA
BH39A	5.5 - 7.0		X	NA	NA	NA
BH40	2.0 - 2.5		X[2]	X	X	X
BH40	6.0 - 6.5[1]		X[2]	X	X	X
BH40A	1.5 - 3.0		X	NA	NA	NA
BH40A	5.0 - 6.5		X	NA	NA	NA
		MS	X	X	X	X
		MSD	X	X	X	X
		Equip. Blank (4)	X	X	X	X
		Trip Blank (3)	X	X	X	X

BH – Borehole.
VOCs – Volatile Organic Compounds.
SVOCs – Semivolatile Organic Compounds.
[1] – Mislabeled as BH40 5.5-5.5 on chain-of-custody.
[2] – Holding time exceeded – resampled.
A – Alternate borehole.
X – Analysis conducted.
TPH – Total Petroleum Hydrocarbons.
MS – Matrix Spike.
MSD – Matrix Spike Duplicate.
NA – Not analyzed
Equip. Blank – Equipment Blank.

detected at a concentration of 0.004 mg/kg in equipment blank 12-011RB collected on 5 January 1994, the day BH36A and BH40A were sampled. This level does approximate the lower levels of toluene found in samples collected that day. This may invalidate the results from boring BH36A.

Ethylbenzene was detected at concentrations ranging from 0.007 mg/kg to a concentration of 0.29 mg/kg. The highest concentrations of ethylbenzene were detected in soil sampled from BH35A and BH40A. Ethylbenzene was detected in soil samples collected from BH35A at concentrations ranging from 0.010 mg/kg to 0.29 mg/kg, with the highest concentration detected in soil sampled from a depth of 1.5 - 2.0 feet BLS. Ethylbenzene was detected in soil samples collected from BH40A at concentrations ranging from 0.007 mg/kg to 0.12 mg/kg, with the highest concentration detected in the field duplicate soil sampled from a depth of 5.0 - 6.5 feet BLS. Ethylbenzene was detected in soil samples collected from BH36A at concentrations ranging from 0.010 mg/kg to 0.053 mg/kg, with the highest concentration detected in the field duplicate soil sampled from a depth of 1.5 - 3.0 feet BLS. Ethylbenzene was not detected in soil samples collected from soil borings BH37A, BH38A, and BH39A.

Xylenes were detected at concentrations ranging from 0.012 to 0.82 mg/kg. The highest concentrations of xylenes were detected in soil sampled from BH40A, at concentrations ranging from 0.02 mg/kg to 0.82 mg/kg, with the highest concentration detected in the field duplicate from a depth of 5.0 - 6.5 feet BLS. Xylenes were detected in soil samples collected from BH35A at a concentration of 0.012 mg/kg from a depth of 1.5 - 2.0 feet BLS. Xylenes were detected in BH36A at a concentration of 0.034 mg/kg, from a field duplicate from a depth of 1.5 - 3.0 feet BLS. Xylenes were not detected in soil samples collected from borings BH37A, BH38A, and BH39A.

BTEX concentrations and cleanup levels as provided by the NDCNR are shown in Table 5.4. As indicated in Table 5.4, BTEX components do not exceed the State cleanup levels. The areal extent of total BTEX is shown on Figure 5.25; however, due to limited data, it could not be contoured. Total BTEX concentrations were arrived at by summing the individual BTEX components for each sample.

5.2.3.3.2 SVOCs

The SVOC di-n-butylphthalate was detected in soil samples BH35 8.0 - 9.0, BH36 1.5 - 2.5, BH36 8.0 - 9.5, BH37 3.0 - 4.0, and BH38 5.0 - 6.5. Diethylphthalate was detected in the soil

Table 5.4
BTEX Compounds and Total BTEX Detected in IRP Site No. 12 Soil Samples
152nd RG, Nevada Air National Guard, Reno, Nevada

Sample ID Number	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Xylenes (mg/kg)	Total BTEX (mg/kg)
BH35A 1.5 - 2.0	0.006	0.012	0.290	0.012	0.32
BH35A 8.5 - 9.0	0.003	0.010	0.010	ND	0.023
BH36A 1.5 - 3.0	0.007	0.015	0.016	ND	0.038
BH36AFD 1.5 - 3.0*	0.023	0.008	0.053	0.034	0.118
BH36A 8.0 - 9.5	0.007	0.008	0.010	ND	0.025
BH40A 1.5 - 3.0	ND	0.015	0.007	0.020	0.042
BH40AFD 1.5 - 3.0*	ND	0.006	0.009	0.044	0.059
BH40A 5.0 - 6.5	ND	0.032	0.025	0.154	0.211
BH40AFD 5.0 - 6.5*	ND	0.057	0.120	0.82**	0.997
NDCNR Cleanup Levels	5	100	70	1,000	

mg/kg – milligrams per kilogram.
BH – Borehole.
FD – Field Duplicate.
ND – Below detection limit.
* – Sample analyzed by Nevada Environmental Laboratory.
** – Compound exceeded calibration range.

sample BH38 5.0 - 6.5. The presence of both compounds is judged to be laboratory contamination, attributable to sample preparation methods prior to analysis. No other SOVCs were detected. Reports of analyses for quality control samples are shown in Appendix F, and reports of analyses for investigative samples are included in Appendix G.

5.2.3.3.3 Lead

Lead detected in soil samples collected at IRP Site No. 12 are shown in Table 5.5. Lead was detected in all soil samples at concentrations ranging from 2.0 to 8.5 ppm (see Table 5.5) and in the trip blank. The trip blank was composed of sodium sulfate and was mistakenly tested for lead. Sodium sulfate is manufactured from sulfuric acid, and lead is present in the processing procedure. Therefore the trip blank is not valid. Analytical results for equipment blanks 12-001RB and 12-002RB were non-detect. Sample 12-001FD 8.0 - 9.5 was a field duplicate of BH36 8.0 - 9.5, and 12-002FD 0.5 - 1.5 was a field duplicate of BH39 0.5 - 1.5. Reports of analyses for quality control samples are shown in Appendix F, and reports of analyses for investigative samples are included in Appendix G.

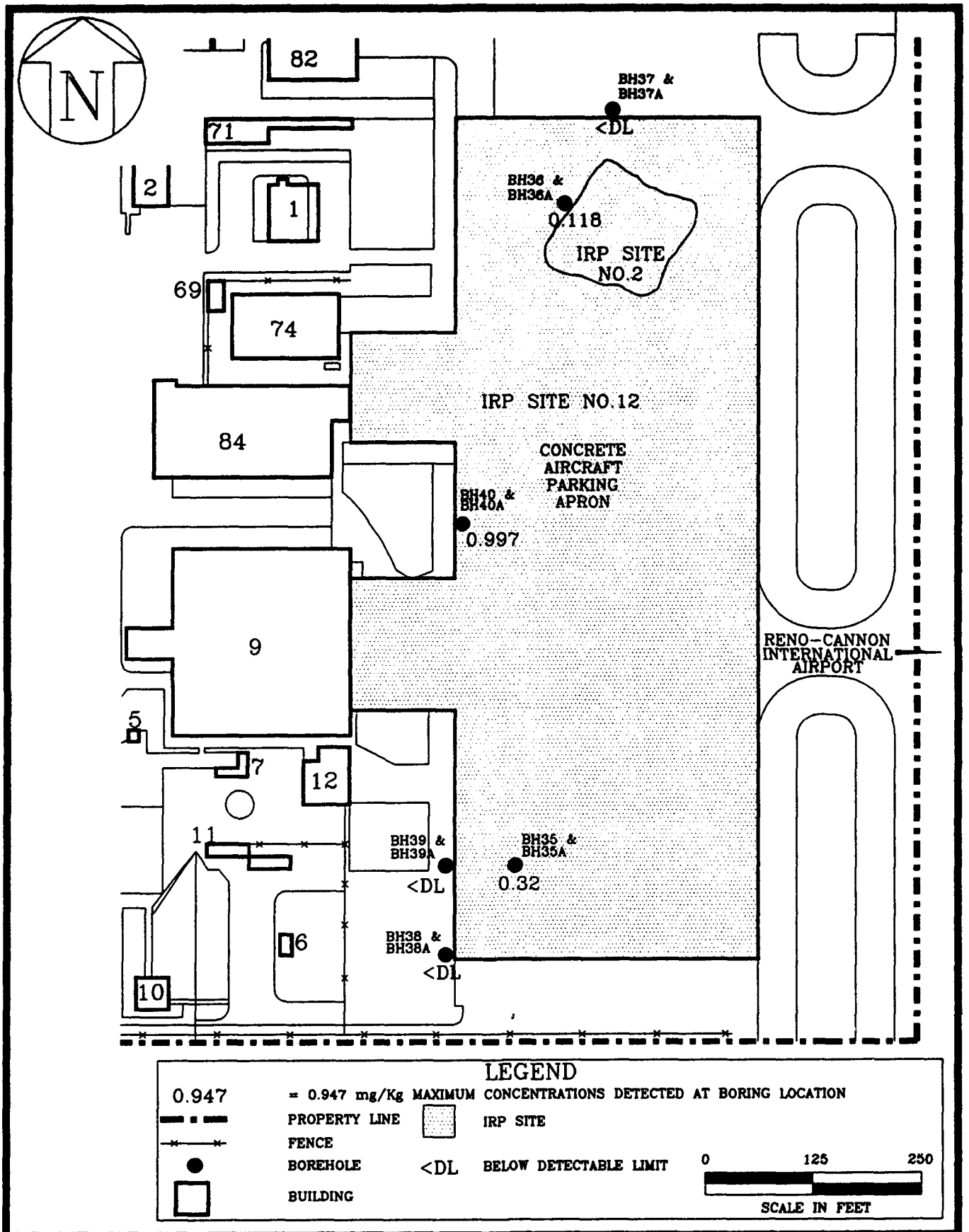

FIGURE 5.25

F:\RENO\MAX-BTEX

MAXIMUM TOTAL BTEX DETECTED IN SOIL SAMPLES
152nd RG, Nevada Air National Guard
Reno, Nevada

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MARCH 1994

Table 5.5
Lead Detected in Soil Samples, IRP Site No. 12
152nd RG, Nevada Air National Guard, Reno, Nevada

Sample ID Number	Lead (ppm)
BH35 1.5 - 2.0	4.2
BH35 8.0 - 9.0	4.1
BH36 1.5 - 2.5	2.4
BH36 8.0 - 9.5	2.2
12-001FD 8.0 - 9.5	3.1
BH37 3.0 - 4.0	2.0
BH37A 6.5 - 8.0*	3.3
BH38 2.0 - 3.5	8.5
BH38 5.0 - 6.5	8.0
BH39 0.5 - 1.5	3.4
12-002FD 0.5 - 1.5	5.7
BH39 5.5 - 7.0	6.4
BH40 2.0 - 2.5	3.8
BH40 6.0 - 6.5**	2.8
Trip Blank	4.6
12-001RB	<.002
12-002RB	<.002

ppm – parts per million.
BH – Borehole.
FD – Field Duplicate.
* – Sampled in January 1994.
** – Mislabeled as BH40 5.5-5.5 on chain-of-custody.

All analytical results for lead are below the mean background concentration determined during the ORNL SI. ORNL reported the mean background concentration of lead at 17.9 mg/kg, with values ranging from 1.79 to 57.8 mg/kg. Cleanup levels for lead contamination are regulated under the Toxicity Characteristic rule, 40 CFR Part 261.24, which lists a cleanup level of 5 mg/L or ppm.

5.2.3.3.4 TPH

TPH was detected at concentrations ranging from 8.0 to 95 ppm in five of the 12 investigative samples and one duplicate sample analyzed for TPH (see Table 5.6). TPH was detected at a concentration of 95 ppm in sample BH40 2.0 - 2.5 and at 28 ppm in sample BH40 6.0 - 6.5. BH40 is located in the area of the high SOV survey reading where a large oil stain was observed on the concrete. TPH was detected at a concentration of 90 ppm in sample BH39 0.5 - 1.5, at

8.0 ppm in sample BH39 5.5 - 7.0, and at 51 ppm in sample BH38 5.0 - 6.5. Borings BH39 and BH38 are at the southwest edge of the parking apron between the parking apron and the POL area. TPH concentrations were found to decrease with depth in borings where TPH was detected with the exception of BH38. TPH was not detected in soil samples collected from borings BH35, BH36, BH37, and BH37A. Illustrated in Figure 5.26 is the areal extent of TPH contamination in soil at IRP Site No. 12. TPH detected did not exceed the State cleanup level of 100 ppm. Reports of analyses for quality control samples are presented in Appendix F, and reports of analyses for investigative samples are presented in Appendix G.

5.2.4 Groundwater Investigation Findings

Fourteen monitoring wells were used to obtain water level data for evaluating horizontal groundwater flow characteristics. Groundwater samples for laboratory analysis were collected from five monitoring wells, and slug test data to determine hydrogeologic characteristics was collected from one monitoring well. Ten investigative and two duplicate groundwater samples were submitted for laboratory analysis from two installed monitoring wells and three previously installed monitoring wells MW2, MW08, and MW24.

Table 5.6
TPH Detected in Soil Samples, IRP Site No. 12
152nd RG, Nevada Air National Guard, Reno, Nevada

Sample ID Number	TPH (ppm)
BH38 5.0 - 6.5	51.0
BH39 0.5 - 1.5	90.0
12-002FD 0.5 - 1.5	82.0
BH39 5.5 - 7.0	8.0
BH40 2.0 - 2.5	95.0
BH40 6.0 - 6.5**	28.0
NDCNR Cleanup Levels	100.0

ppm – parts per million.
BH – Borehole.
FD – Field Duplicate.
TPH – Total petroleum hydrocarbons, California modified 8015.
* – Sampled in January 1994.
** – Mislabeled as BH40 5.5-5.5 on chain-of-custody.

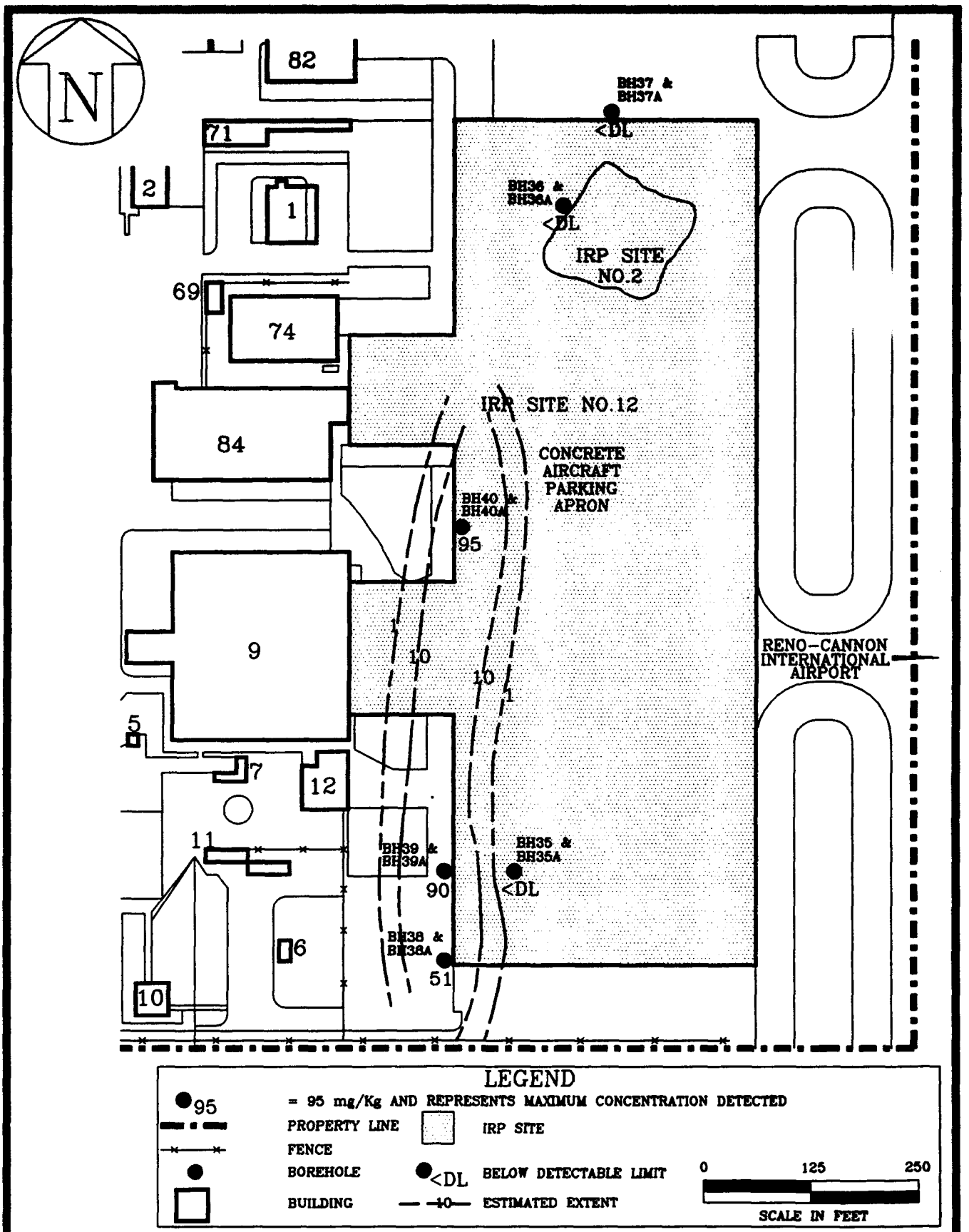

FIGURE 5.26

P:\RENO\MAX-TPH

MAXIMUM TPH DETECTED IN SOIL SAMPLES ISOPACH

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5.2.4.1 Groundwater Monitoring Well Locations

Two monitoring wells, MW26 and MW27, were installed at the site to obtain groundwater samples for laboratory analysis to further provide an assessment of the presence and type of groundwater contamination downgradient at IRP Site No. 12. The locations of the two monitoring wells originally proposed in the work plan were not changed after a review of soil vapor survey results, the GC screening results of soil samples collected from soil borings, and the hydraulic gradient determined by water level measurements in the existing monitoring wells. Monitoring well MW26 is located at the southeast corner of the parking apron. Monitoring well MW27 is located along the east side of the parking apron south of the throat to the taxiway. The locations of MW26, MW27 and the existing monitoring wells investigated are indicated on Figure 5.27.

5.2.4.2 Groundwater Conditions

The monitoring wells installed at IRP Site No. 12 were screened within the younger alluvium Aquifer (Cohen and Loeltz, 1964). Confining conditions were first encountered between 7 and 8 feet BLS within medium- to coarse-grained sand with gravel. The younger alluvium Aquifer is confined and recharged locally by the infiltration of water from the Truckee River (Cohen and Loeltz, 1964). Monitoring well MW27 was drilled on 2 November 1993 to a total depth of 15 feet BLS with the screen set from 4.5 to 14.5 feet BLS. Monitoring well MW26 was drilled on 3 November 1993 to a depth of 15 feet BLS with the screen set from 4.0 to 14.0 feet BLS.

Due to flowing sands in the borings, the screens were not set to the target depth of 5.0 to 15.0 feet BLS. Both monitoring wells were developed on 4 November 1993.

Water level measurements were taken on 4 November and 5 November 1993 and are shown on Table 5.7. Water levels were measured and recorded prior to purging and sampling on 5 November. The work plan called for measuring and recording water levels in monitoring wells MW14 and MW25; however, water levels in monitoring well MW14 were not measured and recorded because the lock could not be opened due to rust. Because of contaminated water

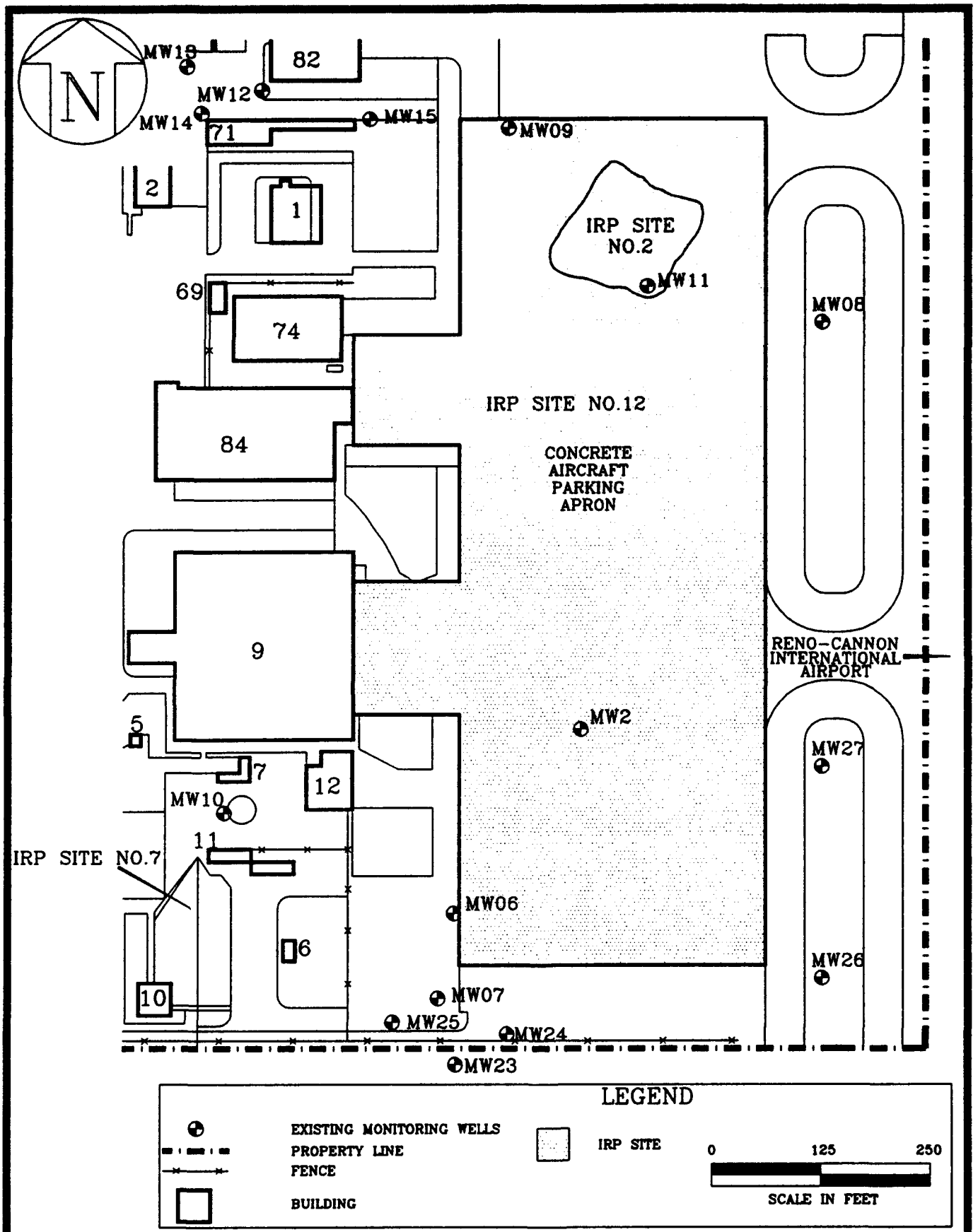

FIGURE 5.27

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LOCATION OF MONITORING WELLS
152nd RG, Nevada Air National Guard
Reno, Nevada

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Table 5.7
Depth to Groundwater and Groundwater Elevations for IRP Site No. 12 Groundwater Monitoring 152nd RG, Nevada Air National Guard, Reno, Nevada

Monitoring Well Number	Date	Depth to Water Table	Elevation of Water Table (MSL)
MW2	4 November 1993 5 November 1993	4.56 4.31	4394.62 4394.87
MW06	4 November 1993 5 November 1993	3.99 4.05	4394.70 4394.64
MW07	4 November 1993 5 November 1993	3.55 3.65	4394.35 4394.25
MW08	4 November 1993 5 November 1993	4.74 4.81	4394.47 4394.40
MW09	4 November 1993 5 November 1993	5.75 5.87	4396.22 4396.10
MW10	4 November 1993 5 November 1993	4.80 4.88	4395.99 4395.91
MW11	4 November 1993 5 November 1993	4.76 4.87	4395.33 4395.22
MW12	4 November 1993 5 November 1993	5.44 5.55	4397.06 4396.95
MW13	4 November 1993 5 November 1993	5.26 5.38	4397.22 4397.10
MW15	4 November 1993 5 November 1993	6.02 6.15	4396.75 4396.62
MW23	4 November 1993 5 November 1993	5.32 5.38	4394.08 4394.02
MW24	4 November 1993 5 November 1993	4.79 4.86	4393.88 4393.81
MW26	4 November 1993 5 November 1993	4.32 4.39	4393.00 4392.93
MW27	4 November 1993 5 November 1993	3.44 3.47	4393.88 4393.85

MSL – Mean Sea Level.
MW – Monitoring Well.

present in the surface vault, water levels in MW25 were not sampled due to the possibility of contaminating the well. Figures 5.28 and 5.29 are the potentiometric surface maps for 4

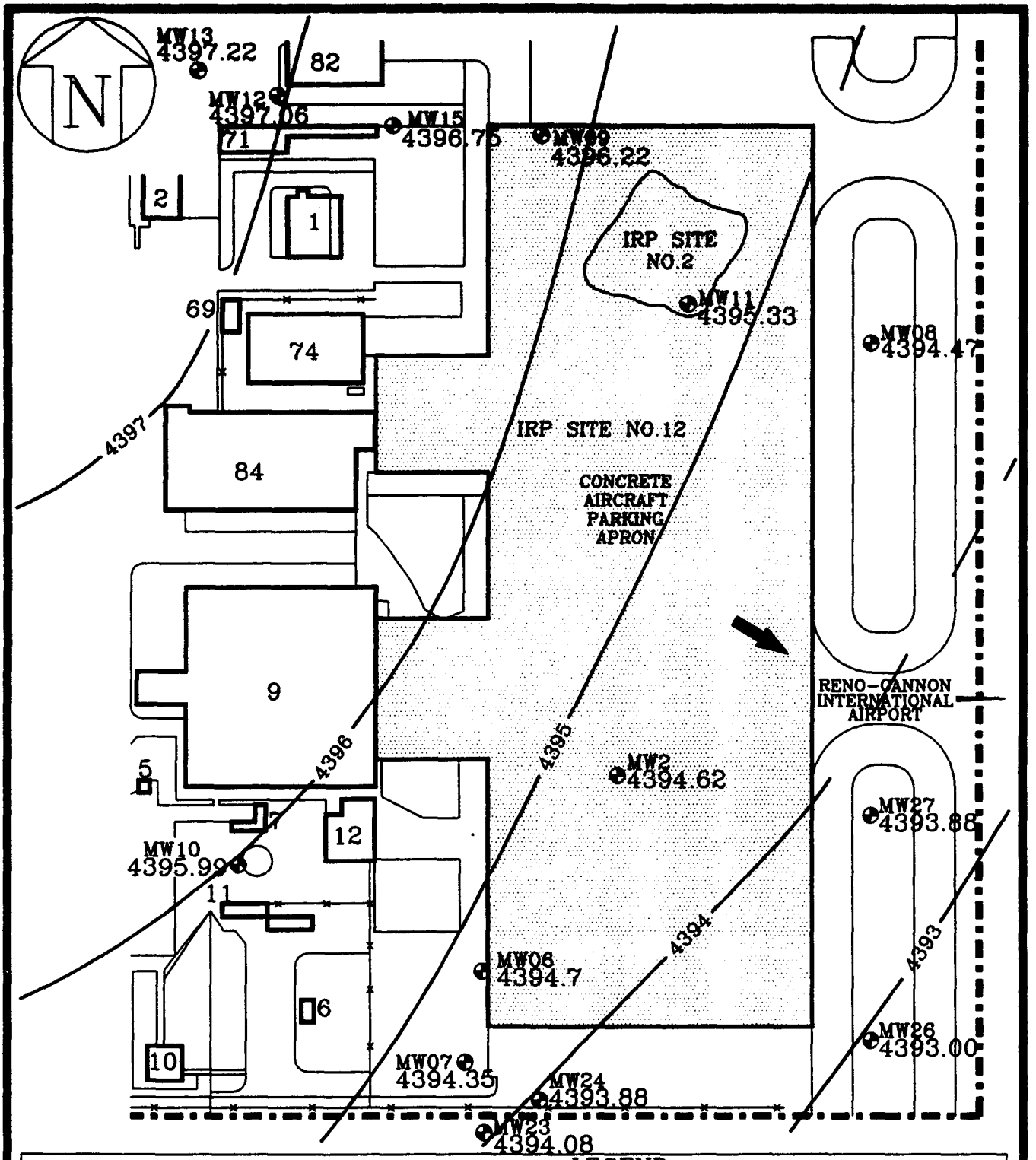

FIGURE 5.28

M:\RENO\POTENTIO

POTENTIOMETRIC SURFACE MAP
ON 4 NOV 1993
152nd RG, Nevada Air National Guard
Reno, Nevada

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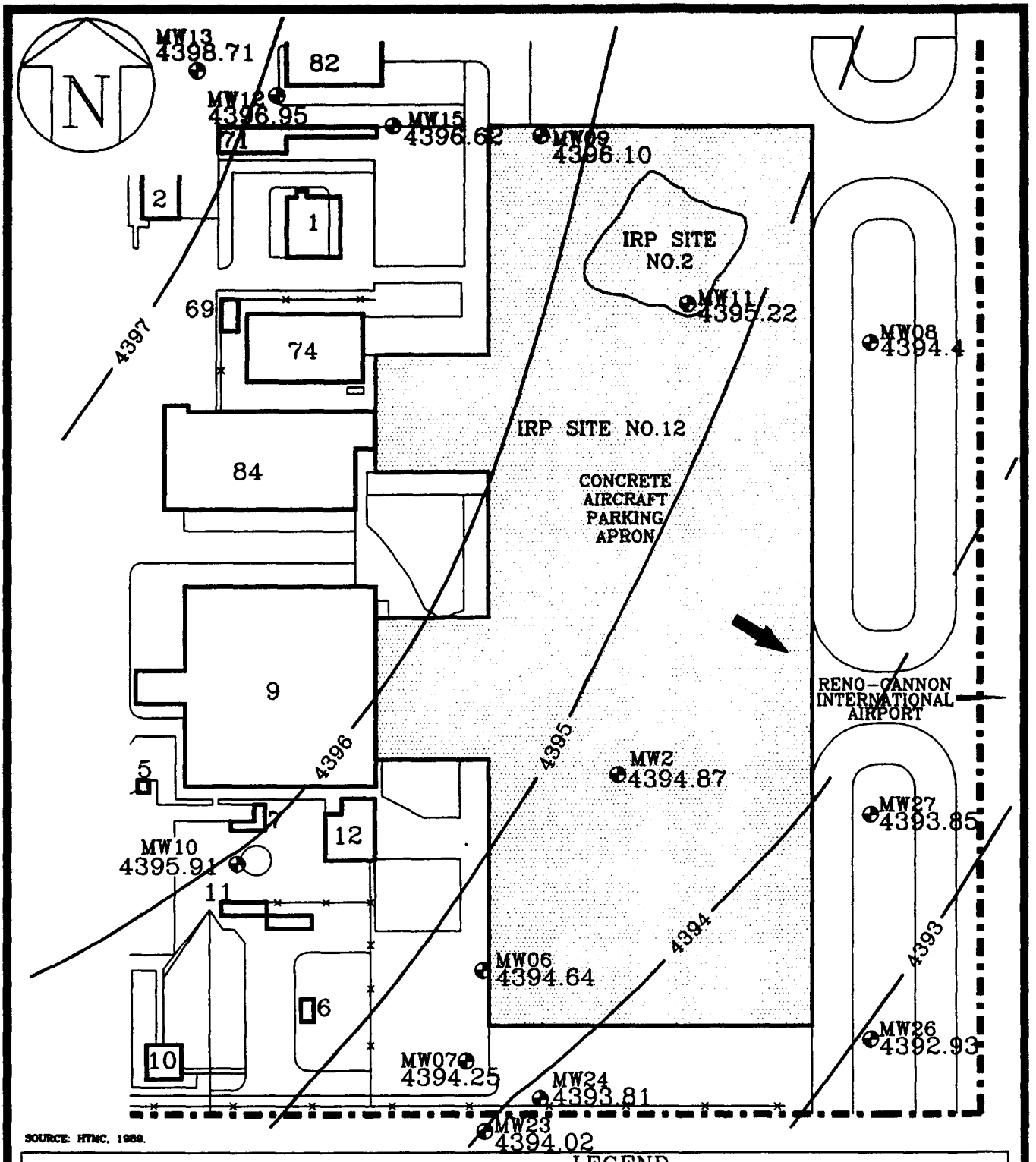

FIGURE 5.29

M:\RENO\POTENTWO

POTENTIOMETRIC SURFACE MAP
ON 5 NOV 1993
152nd RG, Nevada Air National Guard
Reno, Nevada

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November and 5 November 1993 measurements of water levels. Groundwater flow direction is toward the southeast with an average hydraulic gradient of approximately 0.00442 feet per foot.

It was noted during drilling for the installation of the two monitoring wells that the water-bearing sand at approximately 8 to 15 feet BLS in MW27 had a higher clay content in the water-bearing sand whereas MW26 had a low clay content. While purging the two wells for sampling, MW27 would bail dry while MW26 recharged instantaneously. Water flows into both monitoring wells; however, MW26 recharges almost immediately whereas MW27 would bail dry before recharging.

While recording water levels approximately 0.1 foot of free product was measured in MW07. During the ORNL investigation, laboratory analysis of water samples from MW07 indicated high levels of VOCs and SVOCs (ONRL, 1993). Groundwater samples from MW24, less than 100 feet away, were non-detect for VOCs.

Temperature, pH, and specific conductance were measured for each groundwater sample (Table 5.8). Temperature ranged from 57.7° F to 60.3° F. The pH varied from 7.76 to 7.64. Specific conductance ranged from 1190 to 1010 millimhos (mmhos).

Table 5.8
Temperature, pH, and Specific Conductance Measurements for IRP Site No. 12 Groundwater Samples 152nd RG, Nevada Air National Guard, Reno, Nevada

Monitoring Well Number	Date	Temperature (°F)	pH	Specific Conductance (mmhos)
MW26	5 November 1993	60.3	7.64	1010
MW27	5 November 1993	57.7	7.76	1190

°F – degrees Fahrenheit.
mmhos – millimhos.

One slug test was performed on 6 November 1993 at IRP Site No. 12. A summary of the results is given in Table 5.9. The slug test data and analyses are presented in Appendix E.

Table 5.9
MW26 Slug Test Results, IRP Site No. 12
152nd RG, Nevada Air National Guard, Reno, Nevada

Monitoring Well Number	Transmissivity (gal/day/ft)	Horizontal Hydraulic Conductivity (gal/day/ft²)	Horizontal Hydraulic Conductivity (cm/sec)
MW26	5,465	683.1	0.032

gal/day/ft² – gallons per day per square foot.
cm sec – centimeters per second.

The average groundwater flow velocity of 8.62 feet per year was calculated using the horizontal hydraulic conductivity calculated from the slug data. This velocity was computed from the equation:

$$V = \frac{KI}{n}$$

Where:

V = velocity, in feet per day;

K = horizontal hydraulic conductivity, in gallons/day/ft² (gpd/ft²);

I = average hydraulic gradient, in feet per foot; and

n = aquifer effective porosity, no dimensions.

The following values were used:

K = 683.1 gpd/ft², based on the aquifer slug test (see Appendix E);

I = 0.00442 as measured and averaged from Figures 5.24 and 5.25; and

n = 35% based on Freeze and Cherry, 1979.

5.2.4.3 Nature and Extent of Groundwater Contamination

Two groundwater samples were collected from monitoring wells MW26 and MW27. Both rounds of sampling were conducted on 5 November 1993. Samples collected for laboratory analysis during both rounds of sampling consisted of five investigative groundwater samples, one

duplicate sample, one field blank, and one equipment blank. The analytical program for each round of groundwater sampling is indicated in Table 5.10. Results of analyses for all quality control samples are presented in Appendix F. The results of analyses for all groundwater samples are indicated in Table 5.11 and presented in Appendix G.

Table 5.10
Groundwater Sampling and Analytical Program, IRP Site No. 12
152nd RG, Nevada Air National Guard, Reno, Nevada

Monitoring Well Number	Sampling Round	VOCs (SW8020) (µg/L)	SVOCs (SW8270) (µg/L)	Lead (239.2) (ppm)	TPH (CA Mod. 8015) (ppm)
MW2	First	X	X	X	X
MW08	First	X	X	X	X
MW24	First	X	X	X	X
MW26	First	X	X	X	X
MW27	First	X	X	X	X
12-001FD	First	X	X	X	X
12-001FB	First	X	X	X	X
12-001RB	First	X	X	X	X
12-001TB	First	X	NA	NA	NA
MW2	Second	X	X	X	X
MW08	Second	X	X	X	X
MW24	Second	X	X	X	X
MW26	Second	X	X	X	X
MW27	Second	X	X	X	X
12-002FD	Second	X	X	X	X
12-002FB	Second	X	X	X	X
12-002RB	Second	X	X	X	X
12-001TB	Second	X	NA	NA	NA

MW – Monitoring Well.
VOCs – Volatile Organic Compounds.
SVOCs – Semivolatile Organic Compounds.
TPH – Total Petroleum Hydrocarbons.
µg/L – micrograms per Liter.
ppm – parts per million.
FD – Field Duplicate.
FB – Field Blank.
RB – Equipment Blank.
TB – Trip Blank.
NA – Not applicable.

5.2.4.3.1 VOCs

VOCs were not detected in groundwater samples collected from IRP Site No. 12.

Table 5.11
Laboratory Results of Groundwater Sampling, IRP Site No. 12
152nd RG, Nevada Air National Guard, Reno, Nevada

Monitoring Well Number	Sampling Round	VOCs (SW8020) (μg/L)	SVOCs (SW8270) (μg/L)	Lead (239.2) (ppm)	TPH (CA Mod. 8015) (ppm)
MW2	First	ND	ND[3]	0.007	<0.5
MW08	First	ND	ND	0.055	<0.5
MW24	First	ND	ND[4]	0.034	2.3
MW26	First	ND	ND[4]	0.021	2.6
MW27	First	ND	ND	0.006	3.5
12-001FD[1]	First	ND	ND	0.030	<0.5
MW2	Second	ND	ND[4]	<0.002	0.8
MW08	Second	ND	ND[4]	0.016	2.9
MW24	Second	ND	ND	0.024	0.8
MW26	Second	ND	ND	0.030	<0.5
MW27	Second	ND	ND	0.002	4.1
12-002FD[2]	Second	ND	ND	0.025	3.1

MW – Monitoring Well.
VOCs – Volatile Organic Compounds.
SVOCs – Semivolatile Organic Compounds.
TPH – Total Petroleum Hydrocarbons.
μg/L – micrograms per Liter.
ppm – parts per million.
FD – Field Duplicate.
NA – Not applicable.
1 – Field duplicate from MW24.
2 – Field duplicate from MW26.
3 – Di-n-butylphthalate laboratory contamination.
4 – Di-n-octylphthate laboratory contamination.

5.2.4.3.2 SVOCs

The SVOC di-n-butylphthalate was detected in water samples MW2-(1) and 12-002FD. The SVOC di-n-octylphthalate was detected in water samples MW26-(1), MW24-(1), MW08-(2), MW2-(2), 12-001FB, and 12-002FD. Both compounds were determined to be laboratory contamination used for SVOC analysis preparation. No other SVOCs were detected.

5.2.4.3.3 Lead

Lead detected in water samples collected at IRP Site No. 12 are shown in Table 5.12. Lead was detected in water samples from all monitoring wells at concentrations ranging from 0.002 to 0.055 ppm. The State of Nevada uses the Federal drinking water standard (40 CFR 141.11) of 0.050 mg/L (0.050 ppm) for the lead contamination action level. Only the sample from MW08 during the first round of sampling exceeded the Federal standard. All field blanks and equipment blanks were non-detect. Sample 12-001FD was a field duplicate of MW24 during

the first round of sampling. Sample 12-002FD was a field duplicate of MW26 during the second round of sampling. Both field duplicates closely approximated the values reported for the monitoring wells.

The detection of lead in all groundwater samples suggests there may be natural background levels of lead in the water or that there is Site-wide contamination of lead in the groundwater. Previous studies reported no background levels of lead in the groundwater samples from background monitoring wells (ORNL, 1993).

Table 5.12
Lead Detected in Groundwater Samples, IRP Site No. 12
152nd RG, Nevada Air National Guard, Reno, Nevada

Well ID	Sample ID Number	Sample Round	Lead (ppm)
MW2	MW2-(1)	Round 1	0.007
MW08	MW08-(1)	Round 1	0.055
MW24	MW24-(1)	Round 1	0.034
Field Duplicate	12-001FD	Round 1	0.030
MW26	MW26-(1)	Round 1	0.021
MW27	MW27-(1)	Round 1	0.006
Field Blank	12-001FB	Round 1	<0.002
Equipment Blank	12-001RB	Round 1	<0.002
MW2	MW2-(2)	Round 2	<0.002
MW08	MW08-(2)	Round 2	0.016
MW24	MW24-(2)	Round 2	0.024
MW26	MW26-(2)	Round 2	0.030
Field Duplicate	12-002FD	Round 2	0.025
MW27	MW27-(2)	Round 2	0.002
Field Blank	12-002FB	Round 2	<0.002
Equipment Blank	12-002RB	Round 2	<0.002

ppm – parts per million.
MW – Monitoring Well.
FD – Field Duplicate.
FB – Field Blank.
RB – Equipment Blank.

5.2.4.3.4 TPH

TPH detected in water samples collected at IRP Site No. 12 are shown in Table 5.13. Two rounds of sampling were conducted, and five investigative samples and three quality control samples from each round of sampling were collected. The following abnormalities were noted in review of the chemistry results:

Table 5.13
TPH Detected in Groundwater Samples, IRP Site No. 12
152nd RG, Nevada Air National Guard, Reno, Nevada

Well ID	Sample ID Number	Sample Round	TPH (ppm)
MW2	MW2-(1)	Round 1	<0.5
MW08	MW08-(1)	Round 1	<0.5
MW24	MW24-(1)	Round 1	2.3U
Field Duplicate	12-001FD	Round 1	<0.5
MW26	MW26-(1)	Round 1	2.6U
MW27	MW27-(1)	Round 1	3.5U
Field Blank	12-001FB	Round 1	<0.5
Equipment Blank	12-001RB	Round 1	2.2U
MW2	MW2-(2)	Round 2	0.8U
MW08	MW08-(2)	Round 2	2.9U
MW24	MW24-(2)	Round 2	0.8U
MW26	MW26-(2)	Round 2	<0.5
Field Duplicate	12-002FD	Round 2	3.1U
MW27	MW27-(2)	Round 2	4.1U
Field Blank	12-002FB	Round 2	3.3U
Equipment Blank	12-002RB	Round 2	<0.5

U – data flagged because laboratory extraction blank exceeded detection limit but did not exceed three times the detection limit.
ppm – parts per million.
MW – Monitoring Well.
FD – Field Duplicate.
FB – Field Blank.
RB – Equipment Blank.

- Field duplicates were collected during both rounds of sampling from different monitoring wells. Field duplicate 12-001FD was collected from monitoring well MW24 during the first round and 12-002FD was collected from MW26. During the first round, MW24 had a TPH concentration of 2.3 ppm whereas the field duplicate 12-001FD had a TPH level of <0.5 ppm. During the second round, MW26 had a TPH level of <0.5 ppm, and 12-002FD had a TPH level of 3.1 ppm.

- The equipment blank 12-001RB, collected during the first round, had a TPH level of 2.2 ppm, and the field blank 12-002FB, collected during the second round, had a TPH level of 3.3 ppm.

- TPH levels in monitoring wells MW2 and MW08 were reported as less than 0.5 ppm in the first round, but had a reported TPH level of 0.8 ppm and 2.9 ppm, respectively, were reported during the second round.

- The laboratory extraction blank (a standard laboratory QA/QC sample) associated with the TPH groundwater analyses had a TPH concentration of 1.2 ppm (detection limit of 0.5 ppm). This exceedance did not necessitate corrective action because it was less than three times the laboratory-determined detection limit (Handbook to Support the IRP Statement of Work, Air Force Center for Environmental Excellence, Brooks Air Force Base, May 1991). The TPH analytical results were not corrected for the presence of analyte in the blank.

5.2.5 Microbiological Investigation Findings

Four subsurface soil samples were collected and analyzed for microbiological parameters. The samples were selected based on field screening results (field GC and PID), namely one each with no, low, medium and high contamination. The samples selected and their field screening results are shown in Table 5.14.

These soil samples were analyzed for the following microbiological parameters or parameters associated with bioremediation: total heterotrophs (Standard Method 9215), total hydrocarbon degraders, pH (SW9040), moisture (Standard Method 2540), nitrate- and nitrite-nitrogen (EPA Method 353.3), and phosphorous (EPA Method 365.2). The results of these analyses are given in Table 5.15. The trend shown by these results is that a greater microbiological activity (as given by total heterotrophs) is present in samples with greater hydrocarbon contamination.

5.5.6 Geotechnical Investigation Findings

Two soil samples in 6-inch brass sleeves were submitted to Raba-Kistner Consultants, Inc., of San Antonio, Texas, for geotechnical laboratory testing. Permeability and a sieve analysis were performed samples from MW26 1.5 - 3.0 and BH39 5.5 - 7.0. ASTM Method D422 was used

Table 5.14
Soil Samples Selected for Microbiological Analysis
152nd RG, Nevada Air National Guard, Reno, Nevada

Borehole	Interval (Feet BLS)	Field GC Result Total BTEX (ppb)	PID Results (ppm)	Qualitative Contamination
BH38	5.0-6.5	0	0	Zero
BH35	2.0-2.5	0	35	Low
BH40	0.5-2.0	57	2,500	Medium
BH36	1.5-2.5	10,630	1,377	High

BLS – Below Land Surface.
ppb – parts per billion.
ppm – parts per million.

Table 5.15
Microbiological Analysis Results
152nd RG, Nevada Air National Guard, Reno, Nevada

Sample Borehole and Interval (Feet BLS)	pH	Moisture Content (%)	Nitrogen Nitrate (mg/kg)	Nitrate (mg/kg)	Phosphorus (mg/kg)	Total Hetero-trophs (CFU/g)	Hydrocarbon Degraders (CFU/g)
BH38 5.0-6.5	8.37	16.8	1.2	0.06	2.7	405	<10
BH35 2.0-2.5	8.03	5.5	12.5	<0.04	6.2	5,800	<10
BH40 0.5-2.0	8.82	7.2	0.2	<0.04	8.6	8,600	<10
BH36 1.5-2.5	8.01	13.3	0.8	<0.04	6.2	11,000	<10

BLS – Below Land Surface.
mg/kg – milligrams per kilogram.
CFU/g – Colony Forming Units per gram.
BH – Borehole.

for the soil classification and ASTM Method D5084 was used for permeability analyses. The results of the sieve analysis are presented in Table 5.16.

Hydrometer analyses of MW26 1.5 - 3.0 shows 66% silt and 32% clay. The results of the sieve and hydrometer analyses indicated the soil sample from MW26 1.5 - 3.0 is a light brown clayey silt with a trace of fine gravel and the soil sample from BH39 5.5 - 7.0 is a brown sandy silt or clay.

Table 5.16
Geotechnical Investigation Results
152nd RG, Nevada Air National Guard, Reno, Nevada

MW26 1.5 - 3.0		BH39 5.5 - 7.0	
Sieve Size	Passing (%)	Sieve Size	Passing (%)
No. 10	94.6	No. 10	99.3
No. 40	91.6	No. 40	98.2
No. 80	90.2	No. 80	88.0
No. 200	88.0	No. 200	61.5

MW – Monitoring Well.
BH – Borehole.

Permeability is the capacity of a medium for transmitting a fluid and is measured by the rate at which a fluid can move a given distance through a given interval of time. The permeability of MW26 1.5 - 3.0 was determined to be 2.6×10^{-7} cm/sec and the permeability of BH39 5.5 - 7.0 was determined to be 2.9×10^{-8} cm/sec. This permeability is very slow according to the USDA.

5.2.7 Conclusions

Soil and groundwater samples were collected from IRP Site No. 12 and submitted for laboratory analysis to confirm the presence or absence of contamination and to provide data needed to reach a decision point for the site. Past activities at the site indicated that suspected contamination consists primarily of aviation fuel and associated wastes. Therefore, samples were submitted for analysis of VOCs, SVOCs, TPH, and lead.

5.2.7.1 Soil Contamination at IRP Site No. 12

BTEX and TPH at concentrations not exceeding State cleanup levels, were detected at IRP Site No. 12. SVOC contamination was not detected in any soil sampled from IRP Site No. 12.

BTEX was detected in laboratory analyses of soil samples from borings BH35A and BH36A which are located in aircraft parking slots A3 and E2. Similar BTEX contamination probably exists under all other parking slots. BTEX was also detected in boring BH40A in the area of

a high SOV survey reading. It was reported that aircraft were not parked at this location; however, an oil stain was noted on the concrete. BTEX was not detected in boring BH37A north of the apron or in borings BH38A and BH39A located along the southwest edge of the apron between the apron and the POL area. However, ethylbenzene and xylenes were detected from the field GC in both samples from BH39A, and benzene, ethylbenzene, and xylenes were detected in BH37A at 6.5 to 8.0 feet BLS.

BTEX and TPH levels may be higher at the joints where contamination would enter. When conducting an SA at this Aircraft Parking Apron Site, PEER reported TPH levels up to 2,800 mg/kg, benzene up to 620 µg/kg, and total BTEX from 3,100 to 18,320 µg/kg (PEER, 1992). This data is summarized in Section 2.2.1. Borings BH35 and BH36, located in aircraft parking slots, were located 2 feet from any joints between slabs.

Lead was detected in soil samples BH38 2.0 - 3.5, BH38 5.0 - 6.5, BH39 5.5 - 7.0, and 12-002FD 0.5 - 1.5, a field duplicate of BH39 0.5 - 1.5. All four high levels came from boring BH39 and BH38 along the southwest edge of the apron, between the apron and the POL area.

TPH contamination was detected in borings BH38, BH39, and BH40 but at levels below State cleanup levels. The concentrations were generally found to decrease with depth, indicating surface contamination and not contamination of groundwater.

Based upon soil samples from soil borings BH35 and BH36, located in aircraft parking slots, contamination from aircraft is characterized by benzene, toluene, ethylbenzene, and xylenes; background levels of lead, and no SVOCs or TPH contamination. Contamination from borings BH38 and BH39 is characterized by TPH contamination and slightly higher levels of lead but no BTEX or SVOCs. Contamination from boring BH40 is characterized by toluene, ethylbenzene, xylenes, background levels of lead, and TPH contamination. No benzene or SVOCs were detected. This suggests there may be as many as three different sources of soil contamination at IRP Site No. 12 in addition to the old burn pit designated IRP Site No. 2.

5.2.7.2 Groundwater Contamination

No VOCs or SVOCs were detected in groundwater at IRP Site No. 12 from sampling during this SI. PEER (1992) report 2 µg/l ethylbenzene and 4 µg/l xylenes from groundwater samples collected from MW2 (Section 2.2.2). Concentrations of TPH ranged from 0.8 to 4.1 ppm (Table 5.11).

Low levels of lead were detected in water samples from all monitoring wells. A water sample collected from monitoring well MW08 during the first round of sampling (MW08-(1)), was slightly above the Federal drinking water standard of 0.05 ppm.

5.3 INVESTIGATION DERIVED WASTE DISPOSITION

During the SI, a certain amount of waste material (PPE, drill cuttings, and purge water) was produced as a result of investigation activities. All soil cuttings from each drilling location and all well development and purge water from each well location were drummed separately. Miscellaneous derived wastes (PPE and visqueen sheeting) which came in contact with soils having PID readings in excess of 100 ppm were drummed in steel, plastic-lined 55-gallon drums. All drums were properly marked to indicate their contents, the collection date, contractor's name and phone number, and borehole and piezometer/monitoring well ID number. Guidance for the final disposition of drummed materials is provided in this section.

5.3.1 Drums Containing Soil

Soil cuttings for each drilling location were drummed separately. Table 5.17 lists the drilling locations for which drums have been marked "Soil," the recommended disposition of those drums, and the rationale for each recommendation.

Table 5.17
Recommended Disposition of Soil Drums at IRP Site No. 12
152nd RG, Nevada Air National Guard, Reno, Nevada

Drilling Location ID Number	Recommended Disposition	Rationale
BH35	Soil can be disposed of on-site.	Soil sample analyses did not detect contamination exceeding State cleanup levels.
BH36	Soil can be disposed of on-site.	Soil sample analyses did not detect contamination exceeding State cleanup levels.
BH37	Soil can be disposed of on-site.	Soil sample analyses did not detect contamination exceeding State cleanup levels.
BH38	Soil can be disposed of on-site.	Soil sample analyses did not detect contamination exceeding State cleanup levels.
BH39	Soil can be disposed of on-site.	Soil sample analyses did not detect contamination exceeding State cleanup levels.
BH40	Soil can be disposed of on-site.	Soil sample analyses did not detect contamination exceeding State cleanup levels.
MW26	Soil can be disposed of on-site.	PID readings for all soil were less than 100 ppm.
MW27	Soil can be disposed of on-site.	PID readings for all soil were less than 100 ppm.
BH35A	Awaiting State decision.	Field GC analyses detected contamination exceeding State cleanup levels.
BH36A	Soil can be disposed of on-site.	Soil sample analyses did not detect contamination exceeding State cleanup levels.
BH37A	Awaiting State decision.	Field GC analyses detected contamination exceeding State cleanup levels.
BH38A	Awaiting State decision.	Soil sample analyses from twin boring BH38 detected lead exceeding State cleanup levels.
BH39A	Awaiting State decision.	Soil sample analyses from twin boring BH39 detected lead exceeding State cleanup levels.
BH40A	Awaiting State decision.	Field GC analyses detected contamination exceeding State cleanup levels.

ID – Identification.
BH – Borehole.
MW – Monitoring Well.
ppm – parts per million.
PID – Photoionization Detector.
GC – Gas Chromatograph.

5.3.2 Drums Containing Purged Water

Development and purge water from each well location were drummed separately. Table 5.18 lists the well locations for which drums have been marked "Water," the recommended disposition of those drums, and the rationale for each recommendation.

5.3.3 Drums Containing PPE

Drums containing PPE and visqueen lining should be disposed of through DRMO. PPE and visqueen came in contact with soils having PID readings exceeding 100 ppm and also with BTEX and TPH contaminated soils.

Table 5.18
Recommended Disposition of Purged Water Drums at IRP Site No. 12
152nd RG, Nevada Air National Guard, Reno, Nevada

Monitoring Well ID Number	Recommended Disposition	Rationale
MW2	Water can be disposed of on-site.	Groundwater sample analyses did not detect contamination.
M08W	Awaiting State decision.	Groundwater sample analyses detected high levels of lead.
MW24	Water can be disposed of on-site.	Groundwater sample analyses did not detect contamination.
MW26	Water can be disposed of on-site.	Groundwater sample analyses did not detect contamination.
MW27	Water can be disposed of on-site.	Groundwater sample analyses did not detect contamination.
Decon Pad Water	Water should be disposed of through DRMO.	Water quality undetermined.

ID – Identification.
MW – Monitoring Well.
DRMO – Defense Reutilization and Marketing Office.

SECTION 6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 SUMMARY

An SI was conducted at the Aircraft Parking Apron Area, IRP Site No. 12, located at the 152nd RG, NV ANG, Reno-Cannon International Airport, Reno, Nevada. The field investigation conducted by OpTech at the 152nd RG commenced on 25 October 1993 and was completed 6 January 1994. Two previous investigations, PEER and ORNL, have been conducted at or in the immediate area of the site.

6.2 CONCLUSIONS

Soil vapor survey results indicate VOC contamination is present in the subsurface at each of the five rows where aircraft are parked at the site. Contaminant concentrations detected in soil samples collected during the SI did not exceed NDCNR cleanup levels. However, soil and groundwater samples collected during the PEER and ORNL investigations did exceed State cleanup levels. Contamination is limited to the immediate area of the site and specifically to the five rows where aircraft are parked.

Results of the microbiological investigation indicate that *in-situ* bioremediation techniques such as bioventing or bioaugmentation would be suitable for reducing hydrocarbon contamination in the soil. More information is needed to determine whether oxygen, oxygen and nutrients or addition of microorganisms is required to obtain optimum bioremediation at the site.

6.2.1 Soil Vapor Survey

The soil vapor survey consisted of a total of 75 sampling points. Soil vapor survey samples were obtained from depths of 2 feet BLS and 5 feet BLS. One hundred and fifty investigative samples were collected. All samples were analyzed for BTEX using USEPA Method 602 and total FID volatiles. Benzene, toluene, ethylbenzene, and/or xylenes were detected in 70 of the 150 soil vapor samples.

The maximum concentrations of benzene, toluene, ethylbenzene, and xylenes are 481 μg/L, 2,428 μg/L, 1,692 μg/L and 897 μg/L, respectively. Benzene has a limited areal extent but is concentrated under the rows of parked aircraft. Toluene has a larger areal extent which is concentrated under the aircraft parking areas and which also decreases with depth. The highest concentration of toluene is in the general area of the old burn pit designated IRP Site No. 2. Both ethylbenzene and the xylenes have a similar areal extent and concentrations.

Maximum total FID volatiles detected was 103,370 μg/L. High concentrations were detected in soil vapor samples collected from sampling location numbers 9 and 12 which are in the vicinity of the old burn pit designated IRP Site No. 2. A high concentration was also detected in samples collected from sampling location number 31.

6.2.2 Soil Contamination

Soil samples were collected from 12 soil borings (six original soil borings and six twinned soil borings) and two monitoring wells. A total of 23 investigative soil samples were submitted for laboratory analysis of VOCs, SVOCs, TPH, and lead.

BTEX and TPH were detected in soil samples at IRP Site No. 12 at concentrations not exceeding NDCNR cleanup levels. However, borings were located a minimum of 2 feet from joints and cracks in the concrete to prevent damage to the parking apron. BTEX and TPH concentrations can be expected to be higher at these locations where contamination would more easily penetrate the concrete apron. Also, of the six boring locations, only two were located at aircraft parking slots. Three were located just beyond the perimeter of the site, and one was located on the west edge of the apron at a location with high soil vapor concentrations. It is noted TPH and benzene concentrations detected in soil samples collected during the PEER and ORNL investigations exceeded NDCNR cleanup levels.

Benzene was detected at concentrations ranging from 0.006 mg/kg to 0.023 mg/kg. The highest concentration of benzene was detected in soil sampled from soil boring BH36A, located in aircraft parking slot A3. Toluene was detected at concentrations ranging from 0.006 mg/kg to

0.057 mg/kg. The highest concentrations of toluene were detected in soil sampled from BH40A at concentrations ranging from 0.006 to 0.057 mg/kg, with the highest concentration detected in soil sampled from a depth of 5.0 - 6.5 feet BLS. Ethylbenzene was detected at concentrations ranging from 0.007 mg/kg to a concentration of 0.29 mg/kg. The highest concentrations of ethylbenzene were detected in soil sampled from BH35A and BH40A. Ethylbenzene was detected in soil samples collected from BH35A at concentrations ranging from 0.010 mg/kg to 0.29 mg/kg, with the highest concentration detected in soil sampled from a depth of 1.5 - 2.0 feet BLS. Xylenes were detected at concentrations ranging from 0.012 to 0.82 mg/kg. The highest concentrations of xylenes were detected in soil sampled from BH40A, at concentrations ranging from 0.02 mg/kg to 0.82 mg/kg, with the highest concentration detected in the field duplicate from a depth of 5.0 - 6.5 feet BLS.

Cleanup levels for BTEX contamination are provided by the NDCNR. State cleanup levels for benzene, toluene, ethylbenzene, and xylenes are 5 ppm, 100 ppm, 70 ppm, and 1,000 ppm, respectively.

TPH was detected at concentrations ranging from 8.0 to 95 ppm in five of the 12 investigative samples and one duplicate sample analyzed for TPH. TPH was detected at a concentration of 95 ppm in sample BH40 2.0 - 2.5 and at 28 ppm in sample BH40 6.0 - 6.5. BH40 is located in the area of the high SOV survey reading where a large oil stain was observed on the concrete. TPH was detected at a concentration of 90 ppm in sample BH39 0.5 - 1.5, at 8.0 ppm in sample BH39 5.5 - 7.0, and at 51 ppm in sample BH38 5.0 - 6.5. Borings BH39 and BH38 are at the southwest edge of the parking apron between the parking apron and the POL area. TPH concentrations were found to decrease with depth in borings where TPH was detected with the exception of BH38.

Lead was detected in all soil samples submitted for laboratory analysis. Results of the lead analysis were reported at concentrations below the mean background concentration reported by ORNL.

6.2.3 Groundwater Contamination

Groundwater samples for laboratory analysis were collected from five monitoring wells. Ten investigative and two duplicate groundwater samples were submitted for laboratory analysis from two monitoring wells installed to characterize the site and three previously installed monitoring wells.

Lead was detected in water samples collected from all monitoring wells. A concentration of 0.055 ppm for the water sample collected from monitoring well MW08 during the first round of sampling (MW08-(1)), exceeded the Federal drinking water standard of 0.05 ppm. The background concentration for lead in groundwater has not been determined.

6.2.4 Microbiological Investigation

Four samples were collected for microbiological analyses and were selected based on field screening results (field GC and PID), namely one each with no, low, medium and high contamination. There is significant microbiological activity underneath the site which correlates positively with contamination concentrations detected in soil samples. Total heterotrophs range from 405 to 11,000 CFU/g. Hydrocarbon degraders were not present in the four samples analyzed.

6.3 RECOMMENDATIONS

Based on the results of the SI conducted, the following recommendations are presented:

1. Prepare a Corrective Action Plan to collect soil samples and to delineate and remediate the soil, if required, during the replacement or removal os sections of the Aircraft Parking Apron.

2. Collect groundwater samples from background monitoring wells to determine background concentration of lead in groundwater at the Base.

3. Conduct quarterly groundwater sampling from monitoring well MW-08 for VOCs, SVOCs, and TPH. Lead should be analyses during the first sampling event.

4. Conduct treatability study to determine optimum bioremediation requirements for *in-situ* and *ex-situ* destruction of hydrocarbon contaminants at aircraft parking apron.

5. Conduct a feasibility study to determine a cost effective remediation technology for *in-situ* and *ex-situ* destruction of hydrocarbon contaminants based on soil quantities.

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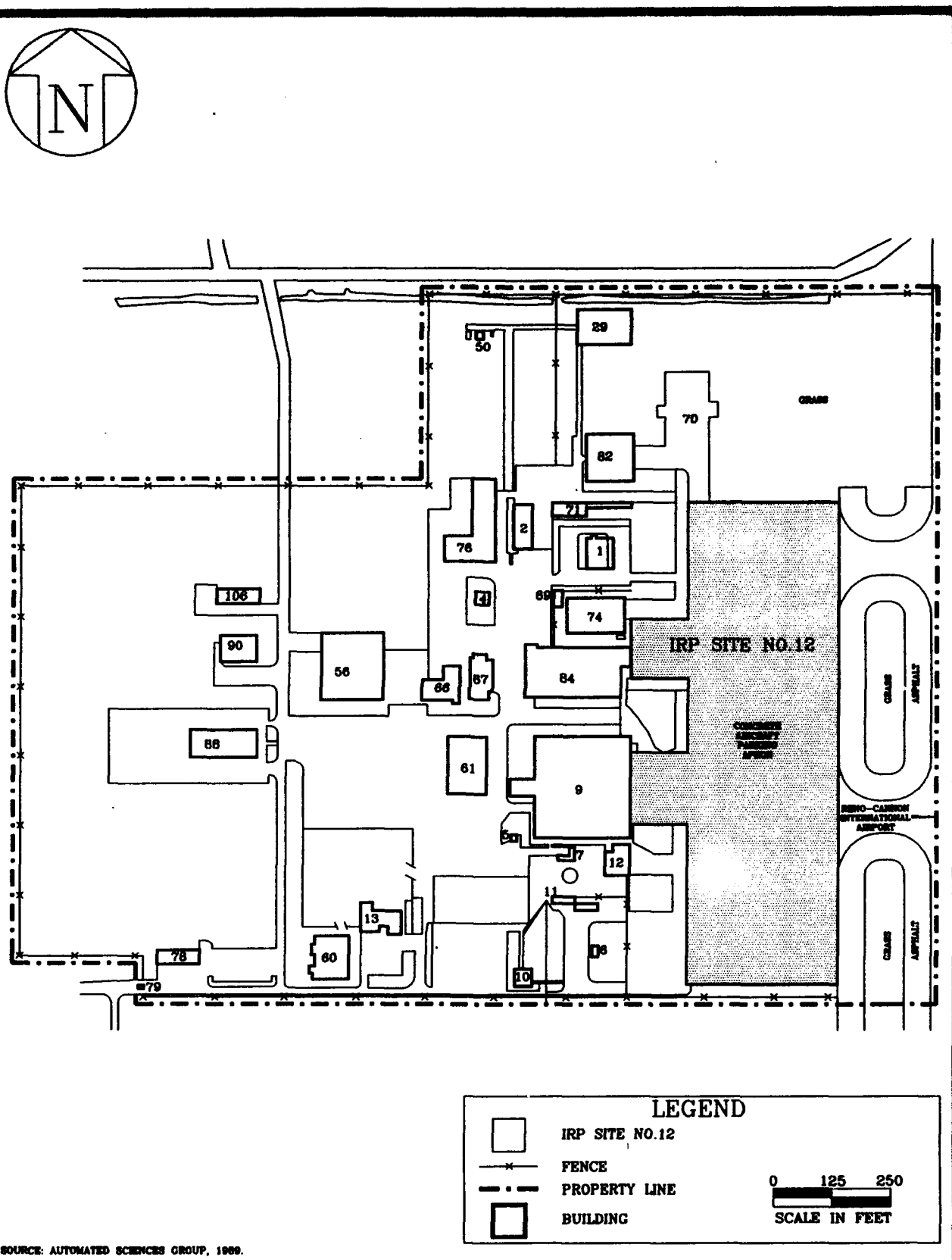

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BASE MAP

152nd RG, Nevada Air National Guard

Reno, Nevada

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MARCH 1994